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THE AMERICAN ANTELOPE, OR PRONG BUCK.

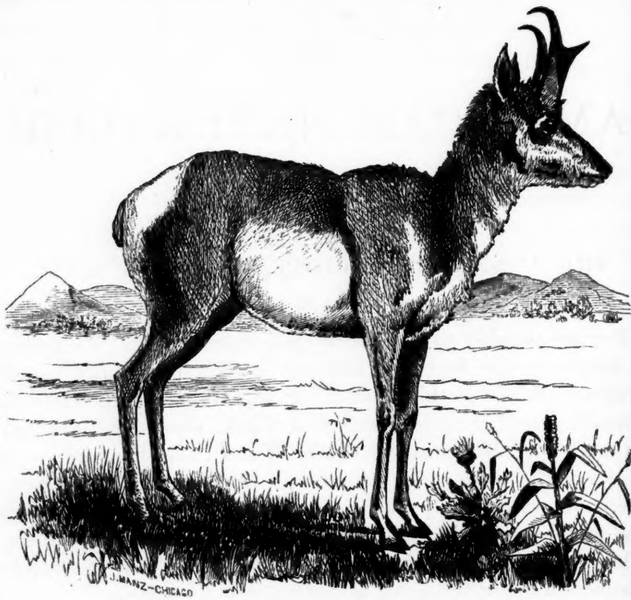
BY HON. J. D. CATON.

IT is not possible to give more than a synopsis of the natural history of the American antelope in the space which may be properly allowed in this journal. It was first made known to the scientific world through Lewis and Clark, who found it in 1804 on the Upper Missouri, and who at times made it an important object of the chase. On their return they brought with them a specimen, which was placed in Peale's Museum, at Philadelphia, and first described by Mr. Ord, and named *Antelope Americana.* Three years later, in *Journal de Physique*, he gave it a generic distinction under the name of *Antilocapra Americana.*

This animal is not a native of the Old World, and is confined to a very limited portion of the New; that is to say, the western part of the continent, mostly within the temperate zone; and since, as we shall hereafter see, it avoids forests and high mountains, it may not be looked for in many portions of this region. It was never found east of the Mississippi River, nor did it even reach the Missouri River except on its upper part, where it crossed that river in the more arid regions.

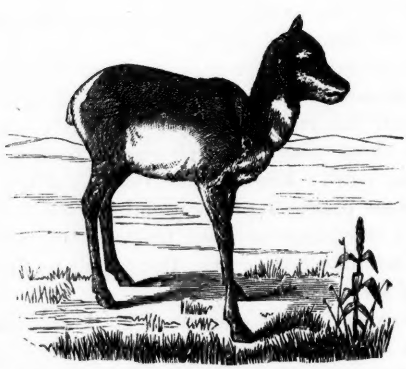
The habits of our antelope explain why it is so confined in its range. Its aliment is strictly herbaceous. It not only rejects arboreous food, but it has such an aversion to forests that it rarely enters them voluntarily, refusing to be driven into them at the greatest peril. True, it will cross thin skirts of timber in passing from one prairie to another, and the old bucks at certain seasons, when they seem inclined to avoid the society of their kind, have been known to seclude themselves in the open, park-like glades of some districts.

They are exceptionally gregarious in their habits, although the immense bands of thousands in which they formerly assem-



(Fig. 10.) PRONG BUCK.

Adult Male, with a longitudinal section of the right horn, showing the core of the horn.



(Fig. 11.) KID OF THE PRONG BUCK, FOUR MONTHS OLD.

bled are now broken up by the advancement of civilization, which has absolutely expelled them from those regions where they were met with in great numbers a quarter of a century since. Then they were most abundant in California, where they sometimes almost literally covered the plains and the foot-hills west of the Sierras, and where now a solitary wanderer is rarely heard of. The parks and plains in the mountains and east of them, and the great table-lands separating the distant ranges, are now most affected by our antelope, for there it finds that dry, gravelly soil, covered by a scanty but nutritious vegetation, which its tastes seem to crave and its nature seems to require; there too, only the shepherd and the herder are induced to intrude upon its seclusion and disturb its quiet.

Although Richardson objects to the appellation *Americana*, because there may be two species of the genus, it is now settled beyond dispute that this animal stands alone, a solitary species of a distinct genus among ruminants, as we shall presently see, differing so widely in many important particulars that zoölogical laws which have hitherto been considered well settled have to be abandoned and new ones recognized. *Capra Americana*, which was once supposed by some to be a species of the same genus, is now well established to be a true goat, and no more related to the animal under consideration than is *Ovis montana*, our Rocky Mountain sheep, and in coat and coloring the latter bears a much stronger resemblance to our animal than the former.

In size, the prong buck (Bartlett) is considerably smaller than the ordinary Virginia deer, and less variation among individuals is observed than occurs in any of the deer family. A fully adult male rarely exceeds four feet in length from tip to tip, and three feet in height to the top of the shoulder, while the adult female is considerably smaller. The hunter never has difficulty in throwing the largest upon his horse or upon his shoulder, and walking to camp with him, though if the distance be great he gets heavy, no doubt.

The form is best understood by reference to the illustration, which is taken from life, of a fully adult male standing at perfect ease. The body is short and round, the tail is very short, the neck is rather short, and is carried very erect. The head is rather broad and short, and carried well up. The ears are small and erect.

The hairs of this animal differ from those found on most of

the hollow-horned ruminants, and possess the extreme characteristics generally observed in those of the deer. They are hollow except near the roots and extreme points, and are filled with a sort of light pith something like that found in the quill of the turkey or the chicken. These hairs are quite non-elastic and fragile, in this respect resembling more those of the caribou than of any other quadruped. The points of the hairs are solid, and hence firm and tenacious, while the lower parts are moistened by an oily secretion from the skin which makes them the more flexible and less liable to be broken. Hence they are found to be most fragile one quarter or one third of the way down from their points. There is present an under coat of fur during the winter, but this is less abundant than on most of the deer.

On the belly the hairs are more solid and tenacious, and on the legs and face they are quite so. On the top of the neck is a distinct mane, more pronounced on the male, consisting of long, erect, and firm red hairs, which are less abundant towards the body.

The illustration of the young kid will show that it is of the same color as the adult, only the shades become deeper on the older animals. The face is generally black to yellowish-brown, with white cheeks. Below each ear is a dark brown or dull black patch. The neck and upper part of the body are of a yellowish-tawny color, often deepening to a brownish shade. On the lower part of the sides the belly and the inguinal regions are white, which color extends up between the hind legs, uniting with the white patch on the rump. This white area extends up under the neck, where it is broken into transverse bands by the yellowish-tawny of the neck. On many specimens a tawny line extends down the back to and along the upper side of the tail, dividing the whole patch on the rump, while in others this is entirely wanting. The white color on all the parts where it is present is entirely immaculate.

The entire absence of the hind or accessory hoofs found in most other ruminants early attracted attention, and distinguishes the prong buck from both the deer and the antelope, between which it seems to stand. Externally, then, the foot is short and broad, without distinct curvatures, and resembles the foot of the true antelope much more than that of the deer.

A very important feature of this animal is the glandular system which it is found to possess. Until quite recently these glands have not been made a subject of special study. They are per-

haps best described and located by Dr. Murie. All are dermal glands. Two are sub-auricular, and covered by the dark patches already mentioned. There are two ischiatic glands at the points of the hips below the tail, and another pair is found at the hocks, and there is an interdigital gland on each foot. Besides the ten glands which may be said to be in pairs, there is a single gland on the top of the back at the anterior border of the white patch. There is no lachrymal sinus.

From these glands is emitted an odor more pungent at some seasons than at others, and more observable from the old males than from the females or the young males; still, it is observable in all at all times.

The eye is exceptionally large for the size of the animal. It is much larger than that of any of the deer, the ox, or the horse. The entire exposed part of the orb is intensely black, so that I have never been able by the closest scrutiny to distinguish the pupil from the iris on the living subject. While it is brilliant, it is mild, soft, and gentle. It is the eye of the antelope gazelle, only larger and blacker, as I have often compared them when standing side by side. This animal has been often called the American gazelle. A female gazelle from Asia, in my grounds, showed a disposition to associate and play with a young prong buck, but with no other animal in the grounds. I have seen our antelope weep copious tears, when in deep affliction.

In domestication this animal loses its wild timidity sooner and more completely than any other animal *feræ naturæ* whose domestication I have attempted. When taken young it soon acquires the attachment of a child for the human species, and when captured adult in a short time becomes so tame that it will take food from the hand and follow one by the hour, walking through the grounds. It soon perceives that it has nothing to fear, and then readily bestows its confidence. It is not generally healthy in domestication, probably from the humidity of our climate and the want of some alimentary element which it finds in its native plains. Many are afflicted with scrofula, and some linger and die without any well-defined disease. I have never yet been able to keep one in my grounds for a single year, but am still continuing my experiments.

I have never yet heard of an instance where they have bred in domestication, although the males especially are excessively salacious in their inclinations; but I have yet to learn of a case of actual fertility.

They show a degree of intelligence scarcely surpassed by that of the dog, which would, no doubt, be greatly improved by succeeding generations under the influence of domestication, should that be proved possible. One that was in the constant habit of following me soon became disgusted with the elk which chased him, so that whenever he saw me going towards the gate which opened into the elk park, he would place himself in front of me and try to push me back, and then look up imploringly, and if I turned away in another direction would gambol about in the greatest delight. In the wild state, at least, this animal is possessed of inordinate curiosity, by which it is often beguiled within reach of the hunter. In this it resembles the barren-ground caribou, or our small Arctic reindeer.

It is the swiftest of foot of all known quadrupeds, but it cannot continue the race at high speed for a great length of time, although for a few miles or a few minutes its escape seems like the flight of a bird. While it can make astonishing horizontal leaps, even from a standing position, it cannot or will not make high vertical leaps. I do not think that one under any circumstances could be driven over an obstruction a yard in height.

Like that of all the deer tribe, its sight is defective, since it is unable to readily identify objects without the aid of motion. Its senses of smell and hearing are very acute, and on these it largely depends to warn it of the approach of enemies.

The most interesting of all the characteristics of the goat antelope, that which most distinguishes it from all other ruminants, is its horns. These appendages are given to both male and female, but on the latter they are scarcely more than rudimentary till they are fully adult, and even then they are quite insignificant, varying from one to three inches in length at the uttermost. The horn of *Antilocapra* is hollow, like the horn of the goat and the ox, and it is deciduous, like the antler of the deer. When this peculiarity was announced, it was received with entire incredulity by naturalists, and the world of science accepted the truth only after overwhelming evidence had been accumulated.

The first allusion I find to the deciduous character of the horns of this antelope is in Audubon and Bachman's Quadrupeds of North America, ii. 198, where we learn that the hunters at Fort Union told Mr. Audubon that the antelopes shed their horns, but the naturalist "managed to prove the contrary." Again, on page 204, he returns to the subject, but says he was never able to ascertain that they do shed their horns.

Dr. Canfield, of Monterey, California, who lived in the midst of vast flocks of antelope, and had domesticated many of them and intelligently studied them, in 1848, in a communication to Professor Baird, of the Smithsonian Institution, announced the deciduous character of their horns quite circumstantially, and gave many interesting facts connected with the animal, but the professor considered the announcement so extraordinary that he did not feel justified in publishing the communication. Five years later Mr. Bartlett, superintendent of the gardens of the Zoölogical Society of London, himself observed the casting of the horns of an adult male then in the society's gardens, and announced the fact to the society in a paper which was published in its Transactions. Since then it has been admitted by naturalists as an established fact.

From the number of these interesting animals which I have had and still have in a state of domestication, my opportunities for observing them have been good, and I have found it the very luxury of study to observe the progress of the growth and the casting of these horns, and to investigate the mode of growth; and I am sure the reader will bear with me while I give a brief description of the process.

The horn of the antelope grows on a permanent process of the skull which rises upon the supra-orbital arch, so that not an inch of space intervenes on the adult between the base of the horn and the orb itself. When the male kid is born, a protuberance may be felt where the horn is to grow. This grows with the kid, and by the time it is six months old, the little horn breaks through the skin, presenting a sharp, hard point. This horn perfects its growth from the first to the last of January, when it has attained a length of an inch or less, and is then cast off. The next horn is perfected and cast earlier, and so on till full maturity is attained, when the horn is thrown off in October, though in this strict uniformity must not be expected.

On the adult male the horn is about twelve inches long, and the core in the specimen now before me is little more than five inches long. The horn is laterally compressed. The lower half is about two and one half inches wide and one inch thick, the anterior edge becoming sharper towards the prong. Above the prong it is much less compressed, assuming more a cylindrical form; still it is somewhat flattened to the end. The prong, which is anterior and occurs about midway the length of the horn, is scarcely more than an abrupt termination of the anterior part of

the flattened section, where its width is increased to about three and a half inches, terminating in a sharp point; so we may say the prong is one inch in length. But in this different specimens vary considerably.

The horn appears as if constructed of a mass of longitudinal fibres, even presenting a striated appearance, especially the lower part, and is roughened by a great number of small tubercles below the prong to near the base. Many hairs occur on the lower portion of the horn, some of which often remain till the latter is shed. In color the horn is a deep black, except the extreme tip, which is generally a translucent yellowish-white, sometimes for half an inch or more.

If we now confine ourselves to the horn on the adult, we shall the better understand it. Soon after the rut-time is passed, we observe the horn, the shell which envelops the persistent core, lifted from its seat and each day carried up higher and higher, and becoming more and more loose till presently it is thrown off. Then it is revealed to us how this has been done. We look inside the cast-off horn and see that the cavity does not extend above the prong, which is scarcely half-way up the horn. We see that the core was laterally compressed, broad and thin, presenting anteriorly its sharpest edge. The illustration shows the form and extent of this core better than I can describe it in words; and so of the horn itself. I represent the side of the horn cut away so as to show the entire core. As we proceed in our examination we see that when the old horn was thrown off the new horn had already made considerable progress in its growth above the end of the core, and that it was this new growth of horn which had dislocated the old one, completely detached it from the core, and so permitted it to drop off. From the hardened point down to the core, the new horn is warm and slightly elastic and flexible, least so towards the hardened point. To watch the growth of the horn henceforward is exceedingly interesting. It extends in length pretty rapidly, and towards the upper end assumes the posterior curvature as the hardening process, which converts it into true horn, progresses downward. Meanwhile the skin which covered the core, and which was rather sparsely set with long, coarse, lightish-colored hairs, shows no unusual activity. But when the perfected horn reached the top of the core, the upper section of this skin, for an inch perhaps, showed unusual activity, and became thicker, its upper part becoming hard and insensible and finally assuming the consistence of true horn, conforming in

shape to the thin, flat core, only that the new horn projects its anterior edge far beyond the core, thus forming the prong; and so the growth proceeds downward, involving but a limited portion of the skin which covers the core, below which it appears to be in a normal condition and above which is the perfected horn, till finally it reaches the base of the horn, when the growth may be considered perfected. This occurs about the last of July or early in August. The progress of the growth is much slower on the lower part of the horn than it was on the upper part. The lower part of the horn, which envelops the core, is covered more or less with hairs which penetrate it from the skin beneath. These we find more abundant as we pass down the horn in our examination. These at last, however, nearly disappear from the surface, probably by abrasion. As soon as or before the commencement of the rutting season, the horn has completed its growth and has become a perfect weapon, and so continues during that season, which so excites the males to belligerency. As this passes by, the growth of the new horn commences at the top of the core and proceeds as before described, lifting the old horn from its seat and finally throwing it off.

I may not occupy the space requisite to describe the peculiarities of the growth of the successive horns and of the cores, while they are growing from the kid to the fully adult, although they show some interesting phenomena. Suffice it to repeat that the first horn of the kid is shed in January; the next year it completes its growth earlier and is shed in December, and so on each year, the horn being shed a few weeks earlier than was its predecessor, till when the animal becomes fully adult the horn is cast soon after the rutting season is past.

I have never had in domestication an adult female, with horns developed, and cannot say whether they mature and are thrown off at the same times as those of the males.

Apparently the skin covering the core of the horn is converted into horn. The microscope alone can reveal the truth of this, and by its aid the whole is made plain. The core of the horn is first covered by the periosteum. Next, and without any intervening tissues, comes the skin, with its proper epidermis. The horns previously described have their roots in the cellular tissue, or lower stratum of the skin, as we will call it. When sufficiently magnified, the upper or outer part of the skin shows the uneven appearance occasioned by elevations and depressions called papillæ, as is observed on other portions of the skin. Upon this uneven

surface rests the epidermis, if we may use that term, where constant activity is ever present. As this epidermis or outer coating of the skin on the human subject, for instance, is constantly wearing away, so must it be constantly renewed by new growths. For this purpose minute cells are constantly being formed upon or next to the papillæ. The new cells, being at the very bottom, necessarily force up their predecessors, which become more and more flattened out in the form of scales. Of these flattened scales the epidermis is formed; as they approach the surface, they become dryer and harder and of a horny nature, even on the most delicate skin, and in that condition these horny scales or flattened cells are worn off by friction. It is these flattened cells which constitute all horns, hoofs, nails, and claws; and so we are not disappointed when we find that the horns of our antelope are composed of these same flattened and dried-up cells. As these cells are forced up and flattened out, they cohere in a mass large enough to form the horn, and in obedience to some law of nature are molded into the proper form. When enough of these flattened and hardened cells have been accumulated and consolidated to constitute the horn at a given place, it cleaves off from the softer inner portion of the cuticle within, leaving a stratum of epidermis covering the corium.

While the mode of growth of this horn so exactly corresponds with that of other and persistent horns, its progress is necessarily widely different. The growth of other horns is very slow and uniform, proceeding from the epidermis at their bases, while this horn, instead of taking a life-time to complete its growth, must be finished in a few months. It is not pushed up and enlarged a little each year by a slow accumulation of these flattened and hardened cells at its base, but it first shoots up with astonishing rapidity from the very top of the core, till the old horn is pushed off and the new one above is far advanced, while over all the rest of the core the cuticle has manifested no unusual activity, but simply a moderate state of vitality is exhibited. When the growth of the horn above the end of the core is completed, the time has arrived for the formation of the new horn below. That part of the epidermis which had been so active and performed such extraordinary work in so short a time relapses into a state of quiet, and a section below has suddenly become aroused to a state of great activity, till it has done its work and completed its horny crust, when in a few days, or weeks at most, it in turn relapses into quiet; and so, as the growth progresses downward,

successive sections become stimulated to great activity, do their work, and subside to quiet, till finally the base is reached and the horn is complete; and now the epidermis has a rest during the rutting season and until the time arrives for the commencement of a new growth, which proceeds as before; and so is it annually repeated.

We can partially understand how it is that the lately active part becomes quiet so soon as the horn over it is perfected, if we will remember that a partial separation takes place between the horn and a sensitive stratum of the epidermis, but I cannot so readily explain how it is that successive sections below are awakened from their state of quietude to an activity nowhere else in nature equaled or even approached for the same purpose. I can only say that the exigencies of the case demand it, and nature supplies the means.

Altogether this is a most interesting animal, requiring peculiar conditions of life for its well-being, which confine it to a very limited area on the face of the earth. The discovery of this animal has opened a new chapter to the naturalist, in which some of his preconceived notions must be rudely swept away, and new possibilities in the animal kingdom recognized. It stands solitary and alone in the middle space where a void was thought to exist, which supposed zoölogical laws had declared could never be filled. It supplies a link in the animal kingdom which we thought could not exist, and which we were slow to recognize when found. It occupies an intermediate place, if it does not entirely fill up the gap, between those ruminants which have hollow and persistent cornuous horns and those which have solid and deciduous ones. It has eight incisors in the lower jaw, and no canine teeth, but twenty-four molars. We find examples of this dental formula in both the above groups. In its skin and coat it is like the deer. Its eye is most like that of some of the antelopes. Its glandular system is most like that of the goat. It is the most delicate and particular feeder of all ruminants, while the goat is the most promiscuous consumer. In its salacious disposition it resembles and even excels the goat, but is the farthest of all from it in its ability to climb rocks and precipices. It has many characteristics hitherto supposed to be confined to one or the other of the families of ruminants above referred to, while it exhibits others peculiar to itself.

Since writing this article I have examined the illustrations here reproduced (see Figures 12 and 13), with the late Mr. Hays's

a. b. c d.

(FIG. 12.)

(FIG. 13.) THE PRONG BUCK. (*After* HAYS.)

Fig. 12.—*a.* The horn just shed. *b.* A longitudinal section, showing the manner in which the hairs pass through the horn. *c.* The appearance of the horn in January. *d.* Its appearance in April.

article on the growth of the horns of the prong buck, in the NATURALIST, volume ii., page 131, and find some differences between his observations and mine, from which we may infer the want of exact uniformity not only in the structure but in the progress of the growth of the horn. The section of the horn shown in Figure 12 shows a core differing in both form and extent from any I have seen. I have never met one where the core extended above the prong.

ARE POTATO BUGS POISONOUS?[1]

BY AUG. R. GROTE AND ADOLPH KAYSER.

A STATEMENT of the poisoning qualities of the *Doryphora decemlineata*, or potato bug, has repeatedly been made in public prints, and notably in the Seventh Report on the Insects of Missouri by Professor C. V. Riley. It is claimed that after coming in contact with the bugs, or inhaling the steam or smoke produced by boiling or burning them, persons have exhibited various symptoms of cutaneous or nervous disease.

To investigate the matter, a quantity of the bugs collected from fields near Buffalo, where no arsenic had been used, was submitted to distillation with salt water, so as to allow of an increased temperature. Under this process, about four ounces of liquid were procured from one quart measure of the insects. This liquid was perfectly clear, and emitted a highly offensive smell; it proved of alkaline reaction on account of the presence of a certain quantity of free ammonia and carbonate of ammonia.

Again, an equal quantity of the bugs was used to prepare a tincture made as follows: Absolute and chemically pure alcohol was condensed upon the live bugs; after a digestion of twenty-four hours the alcohol was evaporated at a gentle heat. The tincture so obtained had a decidedly acid reaction, was brown in color, and was not disagreeable in smell.

To ascertain the effect on the animal system of the liquid and the tincture above described, a number of frogs were procured for the experiment. About one half cubic centimetre of the liquid and the tincture each was introduced separately into the stomach. Neither the liquid nor the tincture produced any apparent effects. The vivacity of the frogs so treated continued unimpaired, notwithstanding the complete retention of the doses. Again, two

[1] Read at the Detroit Meeting of the American Association for the Advancement of Science, 1875.

fresh frogs were submitted to a hypodermic injection of the liquid and the tincture, in the hind legs, by means of an ordinary hypodermic syringe. The injection of the distilled liquid was unattended by injurious results. A slight disinclination, at first, to use the hind limbs was shown also in the case of another frog, which was treated hypodermically with pure water to check the results obtained.

The injection of the tincture, however, proved fatal to the subject. A few moments after the injection the leg operated upon seemed to become paralyzed, and the heart stopped beating within thirty minutes afterwards, by which time the other two hypodermically treated seemed to have completely overcome the effects of the operation.

The tincture, although highly concentrated, contained but a small quantity of animal acids, which, when saturated with bases of potassa and soda, formed deliquescent hexagonal crystals, visible under the microscope, but insufficient in quantity to analyze. It is known that such acids are very active in their effects upon the animal system. The bite of a flea or of a bedbug is attended by an introduction of acids which produce a swelling by the coagulation of the albuminous fluids of the body. The rapid coagulation of milk was shown by the experiment of introducing a few drops of the tincture above described, during the present experiments. In the case of the insects above mentioned, especial organs are occupied with the secretion of the acids which serve the insect economy by coagulating those parts of the blood of the victim which may not be useful for food. No such organs have been noticed in the potato bug. The presence of the acid leads us to conjecture as to the origin of such organs, while they have apparently not become developed in the potato bug. The acids being found to be present in such small quantity, the conclusion is unavoidable, in the light of the present experiments, that the bugs are *not* poisonous.

Rather does it seem likely that the published statements to the contrary were based on erroneous observations, while it is extremely probable that certain of the more aggravated and circumstantially detailed cases of poisoning are due to the effects of arsenic (Paris green and arsenious acid), which is now profusely used for the extermination of the bugs. Many metallic salts will produce cutaneous irritation; when arsenic is sublimed by heat, the inhaled fumes will produce nervous disorder; the effects of Paris green may have been mistaken for those of the potato

bugs. It is credible, moreover, that when larger amounts of the bugs are thrown into a fire to destroy them, even when not containing any arsenic, an incomplete combustion might take place, in which case carbonous oxide (CO) would be produced, which would certainly bring about the evil effects complained of. It may also be remarked that previous to the advent of the potato bug the potato plant itself had not been so freely handled as lately; an inquiry as to the effects of the entrance of the minute hairs from the leaf into the skin, and also into the properties of the juice of the plant, might show cause for some symptoms complained of.

At this time, when the use of arsenious acid is forbidden in Germany in the manufacture of aniline colors, on account of its evil effects on animal organisms, it may not be thought improper to call the attention of the people of our country to the present use of arsenic in the culture of so universal a food plant as the potato.

THE LITTLE MISSOURI "BAD LANDS."

BY J. A. ALLEN.

IN Western Dakota are what are termed the Little Missouri "Bad Lands," a region as picturesque and strange as the imagination can well conceive. As we leave the Missouri River at Fort Abraham Lincoln, the present western terminus of the Northern Pacific Railroad, the journey to these "Bad Lands" is mainly by the so-called Sully's Trail, which runs nearly due westward between the 46th and 47th parallels. The three hundred miles of treeless prairies that lie between the Missouri and Little Missouri rivers present us with nothing of remarkable interest. Gradually, as we advance westward, the grass becomes scantier and the cacti and sage bushes more abundant, evincing the increasing aridity of the climate. Isolated, conical mounds or "buttes," occasionally of considerable height, are seen at long intervals, and serve as important landmarks. The streams are few and small, the most of them dwindling towards the end of summer to a series of detached, brackish pools. Along the larger of them we meet here and there with little clumps of trees, or, more rarely, with continuous narrow belts of timber, consisting mainly of box-elder and cotton-wood, with a sprinkling of elm; or occasionally they are made up almost entirely of oak. These ittle groves, sometimes a day's journey apart, constitute the

only trees met with, — little wooded oases in a vast expanse of rolling, grassy prairie. In crossing these prairies we miss, even in June, when the vegetation is in its greatest freshness, the variety and profusion of flowers that give to the more southern prairies the aspect of a vast flower-garden, — the patches of pink, orange, yellow, and other bright tints produced by the social grouping of the prevailing species, which impart their own hues to broad areas of the landscape, as do often the buttercups and daisies to New England hill-sides. Most conspicuous on the Dakota prairies, west of the Missouri, are the little prairie roses (*Rosa blanda* Ait.), which fill the air with their delicate perfume, and seem often to almost cover the ground in their abundance. These gems of the prairie in a measure atone for the absence of a greater variety of showy flowering plants.

Bird life is abundant over these prairies, they being everywhere enlivened by the few peculiar kinds, such as larks, buntings, and sparrows, that so eminently characterize the Plains. Among them, however, the ornithologist detects with delight both the Missouri skylark (*Neocorys Spraguei* Scl.) and Baird's bunting (*Centronyx Bairdii* Bd.), species which until a few years since were among the least known of the birds of the continent. Few mammals attract our attention, the prong horn, or so-called "antelope" (*Antilocapra Americana* Ord), being the chief, which, while notable for its grace and beauty, is also the principal game animal of this portion of the Plains; the American bison, or "buffalo," which existed here but a few years since, and whose trails still remain, having now wholly disappeared from the region east of the Yellowstone. The "prairie-dog towns" are somewhat frequent, their little occupants being ever objects of interest; occasionally the prairie hare (*Lepus campestris* Bach.), or jackass rabbit, as more commonly called, surprised by our approach, scampers away in all possible haste, his immense ears and very long legs giving him the appearance of being much larger than he really is.

After days of pleasant journeying amid such scenes as these, we find ourselves upon the border of the "Bad Lands," to the exploration of which we have long looked forward with so much interest. Though they are but a few miles distant, there is nothing as yet to indicate their proximity; we see before us only the same low ridge that in prairie landscapes seems ever to bound the horizon. Reaching the crest of this low ridge, however, we have before us, instead of another similar swell, one of

the strangest vistas the continent affords. We look down upon a broad valley studded with detached, nearly bare, conical, pyramidal, and rectangular mounds, one hundred to several hundred feet in height, and a few yards to many hundred yards in length. All are similarly capped with a stratum of bright red, indurated clay, which on closer examination proves to have been metamorphosed by heat, and to be mixed with cinders and other mineral substances that seem to have had a volcanic origin. The mounds themselves are made up of variegated shales, horizontally disposed, which, seen in section in the nearly vertical sides of the mounds, appear as parallel bands of yellow, brown, green, gray, black, and other tints, surmounted with red. This strange panorama extends for many miles, and as we gaze upon it for the first time we soon cease to wonder that General Sully, in his march through this region in 1864, should have likened it to "*hell with the fires out*," as he is currently reported to have done.

The trail we have chosen fortunately leads us through the very heart of this interesting country, so that the experiences of a single day even would be sufficient to give us considerable familiarity with the varied phenomena of a locality that may be taken as a fair illustration of the remarkable topography of an extensive region. By a difficult and winding descent we reach the valley of Davis Creek, through which we are to find our way to the Little Missouri. Our interest in our surroundings constantly increases, as at every step some new feature, noticeable for its picturesque effect or as illustrative of some geological force, attracts our attention. The mounds and ridges increase in height, their rounded summits still capped with bright pink shale, and almost verdureless. Red bands are also seen at intervals in the sides of these mounds, these bands being composed of the same baked, reddened clay as that covering the summits, with generally a thin layer of scoriaceous material at the bottom of each red band. Although traces of fire are so evident, the force that has given the country its present broken character has been the gentle action of water. The strata everywhere preserve their almost perfectly horizontal position, these buttes and sharp, narrow ridges being but the remains of strata that once filled the country to a higher level than even the tops of the highest buttes now standing. By the slow process of aqueous erosion have the soft strata of sands and clays been removed, and the country scored to the depth of hundreds of feet.

But other forces have been at work. Heat of great intensity,

and from an unusual source, has also acted here on a grand scale, but as a preserving rather than as a destroying agent. Beds of lignite, a few inches to several feet in thickness, occur interstratified with the deposits of sand and clay. The deep, sharp gullies formed by the action of water have exposed these beds of lignite for long distances. This exposure to atmospheric influences seems to have in some way produced spontaneous combustion of the lignite, for there is abundant evidence that some of the igneous action about to be described occurred before the close of the terrace epoch. Whatever may have caused the coal beds to take fire, the fact remains that for long ages their destruction has been going on, and even still continues, producing geological results of a most interesting and important character. When once well ignited they seem to burn for long periods, the fires penetrating far into the interior of the hills, extending at times till all the coal seams over very large areas are consumed. At the present time these fires are known to sometimes originate from the prairie fires, which occasionally sweep over these lignite exposures and ignite the coal. But a large proportion of the beds that have been destroyed appear to have been so situated that prairie fires could not have reached them, the exposures being about midway up the bare, nearly vertical faces of very high bluffs. Wherever the lignite beds have been burned, their former position can be easily detected by the bright red bands of the hardened overlying clays and sands which have been metamorphosed by their combustion, these red bands being often traceable by their color for long distances, occurring at the same level in butte after butte.

The burning of such large masses of lignite must of course, especially when the beds have considerable thickness, produce an intense heat; yet the metamorphism here seen seems sometimes to be on too grand a scale to be the result of so limited a cause. The thickness of the strata more or less changed in texture and color by the heat varies, of course, with the thickness of the seam of lignite the burning of which was the source of the metamorphic action, and hence ranges from a few feet to twenty or thirty, and occasionally to upwards of fifty! In many cases the heat was sufficient to partly or wholly fuse the shales immediately in contact with the burning lignite, giving them a semi-vitreous or porcelaneous texture. At the bottom of the series of metamorphosed beds we have usually a layer of cinders and clinkers, which occupies the position of the former lignite bed itself. This

layer is generally of a whitish or grayish color, and is made up largely of hard, semi-vitreous, vesicular material, the larger interstices of which are filled with ashy or earthy matter, while occasionally portions are so soft as to be easily crumbled in the hand, or crushed under the foot. Indeed, it is not much unlike the residuum left in our grates from the burning of common coal.

The material next above this often shows signs of having been in a semi-molten or at least plastic condition, and generally presents a great variety of tints, as olive, drab, yellow, gray, white, brown of various shades, purple, and even black. The purple and olive tints are quite frequent; the other colors often occur in narrow zones or mere lines, producing a very beautiful effect. The texture varies from a dense, compact, jaspery character to that so porous and vesicular that the mass will float upon water, with every degree of porosity between these extremes. This variegated layer is usually but a few inches in thickness, and is of rather local occurrence, as is also the scoriaceous or vesicular matter, neither appearing except where the heat has been very intense. The scoriaceous material also varies greatly in color, being usually black, but sometimes grayish, while it also occurs of every shade of red, from dark reddish-brown to bright carmine. These materials always pass gradually into the overlying reddened, baked clays, which, as previously stated, may vary in thickness from a few feet to twenty or more, and which, from their great thickness, bright color, and wide distribution, form one of the characteristic features of the region we are considering. The color of these beds is that of bright red bricks, and where the material has been thinly scattered about by the gradual demolition of buttes once covered by it, as sometimes happens, the resemblance of the locality to an old, long-abandoned brickyard is very striking. These hardened clays still retain the abundant impressions of plant-remains, but they are generally too fragmentary to be of much value as specimens. A few quite well-preserved casts of the leaves of exogenous plants occur, but the vegetable relics consist mainly of the imprints of broad-leaved grasses and sedges, which seem to have in places nearly filled the clays. Heavy clay deposits almost always immediately overlie the beds of lignite, and when they are very heavy, or the seam of lignite is very thin, the metamorphism scarcely extends beyond the stratum of clay; usually, however, it affects the stratum of sand that rests upon the clay, sometimes converting it into a red, coarse-grained, rather soft sandstone, hand-specimens of

which are scarcely, if at all, distinguishable from the red sandstone of the Connecticut Valley. The metamorphism gradually ceases in passing upward, as respects both color and hardness, till the influence of the heat wholly disappears. The color of these metamorphosed shales thus fades from intense red, or even black, through light brick-red to pale red and pale reddish-yellow; whilst the texture varies from crumbling scoria and slag, through rock of a trappean texture and conchoidal fracture, to finely fissured baked clay and sandstone, and finally to shales but slightly hardened and almost unchanged in color.

The beds thus altered often present interesting features of structure, the indurated clays being extremely fissile, breaking up into thin, small, irregularly shaped splinters and fragments, which possess a clear, metallic resonance; the sandstones occasionally present a prismatic structure, with the planes of cleavage oblique to those of stratification, the mass breaking into five or six sided prisms, half an inch to an inch or two in diameter, and one or two to even two and a half feet in length, almost slender enough and long enough for walking-sticks!

As already intimated, the beds of lignite vary greatly in thickness, from a few inches to five or six feet, and even more,[1] with corresponding variations in the amount of metamorphism produced by their combustion. In the burning of the heavier of these beds not only is an immense amount of heat generated, but vapors are formed which, in escaping, have also left their interesting records. These consist of jagged, chimney-like mounds of breccia that still crown many of the buttes and ridges, the softer materials that surrounded them having been worn away by denuding agencies, leaving them as striking and picturesque features of the landscape. These mounds have sometimes the form of short, thick columns, being circular, a foot or two in diameter and a few feet high; at other times they are ten or twelve feet in diameter and of about the same height, while they not unfrequently assume the form of low, narrow, ragged walls of highly altered rock, the material of all these erupted mounds presenting the features of a true volcanic breccia. The matter composing these chimneys was mostly forced up through small orifices or narrow fissures,

[1] Near the mouth of Powder River I met with two beds, one five and the other eight feet thick, separated by only about three feet of shale. On Custer's Creek I also met with a heavy bed, which varied in thickness at different exposures from six to ten feet. A considerable amount of metamorphic action may readily be conceived as resulting from the combustion of such large masses of lignite, some of which has nearly the heat-producing power of cannel coal.

while in a plastic or half-molten condition. At these points the heat was so great that the sands and clays through which the fissures extended became thoroughly melted, leaving the walls of these fissures with glazed surfaces, vitrifying them to depths varying from half an inch to several inches. In some instances the melted matter ran down while in a viscous state, solidifying in pendant, rounded masses; in other cases it was squeezed out through lateral cracks in the walls of the main fissures, congealing in similar botryoidal forms. Again, masses are seen in these chimney-like mounds that seem to have been twisted and folded when in a viscous state, the surface still retaining its waxy lustre.

In connection with the formation of these fissures and mounds there were slight disturbances of the adjoining strata, affecting sometimes an area of only a few feet in diameter, and rarely extending over many yards. Occasionally, however, the fissures extended for considerable distances, accompanied by the usual phenomena of intense igneous action already noticed, with a disturbance of the strata for several yards on either side of the fissure, where many feet in thickness were lifted and still remain highly inclined. We have here, in fact, a series of volcanic puffs, or *volcanoes in miniature*, having their seats of action in the burning coal-seam, ten, fifteen, or perhaps fifty feet below. Indeed, some of these disturbed areas present a very broken and volcanic aspect, and a geologist suddenly transported to one of these localities would feel at first that he must be in the midst of a truly volcanic district. He would find that from the tops of these apparently volcanic ridges blocks of scoriaceous material, differing in no respect from real volcanic products, have rolled down into the adjoining valleys, and lie scattered in masses varying from a foot in diameter to those of several tons' weight. The ragged masses of rock crowning the higher points of the ridges, like ruined battlements, with the adjoining chasm-like ravines, faced with highly metamorphosed rock, do combine, in fact, to present quite a disturbed and chaotic scene; yet a careful examination of even these localities shows that the strata are everywhere horizontal, save at such few limited areas as those already noticed. We find here, as usual, the horizontal beds of cinders underlying the metamorphosed strata, differing from those of other localities only in their greater thickness, and pointing out most conclusively the origin and cause of these local disruptions and former intense igneous action. That the burning of the lignite beds is really competent to produce all these effects

we have the abundant stratigraphical proof afforded by this whole region, and the further testimony of trustworthy eye-witnesses, who have seen the beds of ligniteon fire with the same phenomena resulting as those above described.

The effect of this metamorphic action, when we consider its cause, upon the general topographical and geological features of the region under consideration, is wonderful almost beyond conception. Wherever the country is deeply scored by ravines usually several of these red bands of metamorphosed shales occur, separated by fifty to one hundred and fifty or more feet of unaltered clays and sands, and, running horizontally and parallel to each other, are seen for many miles, passing at the same elevation through butte after butte and ridge after ridge. The highest points are invariably capped with this hardened material, and hence all rise to about the same level over an area of many square miles. Generally there are several sets of these elevations, differing only in size and height, the hardened bands that cap the smaller and lower appearing at the same elevation in the sides of the larger and higher, which are capped with portions of higher beds that have nearly disappeared. The indurated beds thus in a great measure determine the height and form of these remnants of strata which once filled the valleys to a height considerably above the tops of the highest points now left, and serve as a great check upon the surprisingly rapid erosion now going on, and which is every year removing vast quantities of the easily yielding strata.

The extent of the influence of this igneous action upon the general aspect and character of the country is perhaps most impressively seen from elevations that overlook considerable areas of these strange "Bad Lands;" the scene of course varying greatly in its topographical details with every change in the position from which it is viewed. From a high point on the western bank of the Little Missouri, nearly opposite the mouth of Davis Creek, the view is that of a vast expanse of verdureless mounds and walls of naked rock, interspersed here and there with little grassy plateaux, and crossed by the green valley of Davis Creek, with its scanty fringe of low trees. Bright red is the prevailing color of the landscape, but in the nearer ridges the bands of yellowish-brown, dark-brown, and grayish shades are also distinguishable. The surface of the country is everywhere deeply scored, some of the higher points being two hundred and fifty to three hundred feet above the bed of the Little Missouri, and the

eye catches little else than the bare, more or less metamorphosed shales. Each hardened band forming a considerable check to the eroding forces, the country presents a series of narrow terraces; these, being covered with a scanty growth of vegetation, form little plats and strips of green that pleasantly relieve the otherwise unbroken expanse of barrenness. Such a scene of wildness and desolation seems like a glimpse, as it were, of a half-formed world, unfit as yet for the habitation of man or for his uses.

A more extensive view of the Little Missouri "Bad Lands" is obtainable from the Sentinel Buttes, two high points situated on the western border of this remarkable region, and reaching an elevation of about six hundred feet above the Little Missouri. The horizontal position of the strata composing these elevations shows what a vast amount of material has been removed from the surrounding region by the slow action of denuding forces. The country presents, as we look eastward from these buttes, an almost continuous expanse of low, red-capped ridges and buttes, the prevailing red color being relieved only by bands of yellowish-brown and gray tints formed by the unaltered shales exposed in the deeply cut ravines. In this direction the view consists almost wholly of bad lands, — a vast stretch of undulating, verdureless red surface, extending as far as the eye can reach, only the naked crests of the distant, red-capped buttes and ridges being visible. It is a scene not easily forgotten, so utterly barren, and yet so wild and picturesque. Its desolateness is doubtless greatly heightened by the contrast of green, rolling prairie which meets the eye when turned in the opposite direction. In looking northward or southward we have on the one hand a beautiful prairie landscape, broken only here and there by a low, red-capped butte or sharp ridge, while on the other is a boundless expanse of naked red mounds and ridges, — billows, as it were, of a fiery sea, — the transition from the one to the other being abrupt and strongly marked.

We have here before us but a portion of one of the numerous belts of these peculiar bad lands that occupy vast areas of Eastern Dakota and Western Montana. The Little Missouri "Bad Lands," with a breadth varying from twenty to thirty miles, extend for hundreds of miles along the stream from which they derive their name. Other equally remarkable areas appear at intervals along the Missouri, from the vicinity of Fort Berthold nearly to the Judith River, or for a distance of fully five hundred

miles. Another immense area occurs along the Yellowstone, extending from its mouth nearly up to the Big Horn River, or for several hundred miles, as well as for long distances up its lower tributaries. The valleys of the Rosebud, Tongue, and Powder rivers are, indeed, among the most noteworthy localities of these metamorphic phenomena, the hills being sometimes reddened as far as the eye can reach by the burning out of the lignite beds. This metamorphism is, in short, almost coextensive with the lignitic tertiary formation of the Upper Missouri, which occupies an area some five hundred miles in length by about three hundred and fifty in breadth, extending from near the 100th to about the 108th meridian, and from the vicinity of the 43d to far beyond the 49th parallel. Within this region, however, are occasional districts where this metamorphism occurs only in the higher, scattered buttes, the great areas of this disturbance and change being the borders of the principal water-courses, as the Missouri and its southern tributaries between the above-named points, including the Yellowstone and its eastern affluents.

JUMPING SEEDS AND GALLS.

AT a late meeting of the Academy of Sciences of St. Louis, Mr. C. V. Riley exhibited certain seeds which possessed a hidden power of jumping and moving about on the table. He stated that he had recently received them from Mr. G. W. Barnes, of San Diego, Cal., and that they were generally known by the name of "Mexican jumping seeds." They are probably derived from a tricoccous euphorbiaceous plant. Each of the seeds measures about one third of an inch in length, and has two flat sides, meeting at an obtuse angle, and a third broader, convex side, with a medial carina. If cut open, each is found to contain a single fat, whitish worm, which has eaten all the contents of the seed and lined the shell with a delicate carpet of silk. The worm very closely resembles the common apple worm (*Carpocapsa pomonella*), and indeed is very closely related, the insect being known to science as *Carpocapsa saltitans*. It was first recorded by Westwood in the Proceedings of the Ashmolean Society of Oxford, in 1857 (iii. 137, 138), and repeatedly referred to under the name of *Carpocapsa Dehaisiana* in the Annales of the French Entomological Society for 1859.

The egg of the moth is doubtless laid on the young pod, which contains the three angular seeds, and the worm gnaws into the suc-

culent seed, which, in after growth, closes up the minute hole of entrance, just as in the case of the common pea weevil (*Bruchus pisi*). Toward the month of February the larva eats a circular hole through the hard shell of its habitation, and then closes it again with a little plug of silk so admirably adjusted that the future moth, which will have no jaws to cut with, may escape from its prison. A slight cocoon is then spun within the seed, with a passage-way leading to the circular door; and the hitherto restless larva assumes the quiescent pupa state. Shortly afterwards the pupa works to the door, pushes it open, and the little moth escapes. When ripe, the shell is very light, and, as the worm occupies but about one sixth the inclosed space, the slightest motion will cause the seed to rock from one of the flat sides to the other. But the seed is often made to jerk and jump, and, though this has been denied by many authors, Mr. Riley had had abundant proof of the fact, and had seen the seed jerked several lines forward at a bound, and raised a line or more from the surface on which it rested. If the seed be cut, the worm will soon cover up the hole with a transparent membrane of silk; and if two of the opposite angles be cut, the movements of the worm can then be seen, if the seed be held against the light. It thus becomes evident that the jerking motion is conveyed by the worm holding fast to the silken lining by its anal and four hind abdominal prolegs, which have very strong hooks, and then drawing back the head and fore-body and tapping the wall of its cell with the head, sometimes thrown from side to side, but more often brought directly down, as in the motion of a woodpecker's head when tapping for insects. In drawing back the fore-body the thoracic part swells, and the horny thoracic legs are withdrawn, so as to assist the jaws in receiving the shock of the tap, which is very vigorous, and often given at the rate of two a second and for twenty or more times without interruption. It is remarkable that this, of all the numerous seed-inhabiting Lepidopterous larvæ, should possess so curious a habit. The seed will move for several months, because, as with most Tortricidous larvæ, this one remains a long time in the larva state after coming to its growth and before pupating.

Mr. Barnes gives the following account of the plant, received through Captain Polhamus, of Yuma, A. T. It seems to be called both *Yerba de flecha* and *Colliguaja* by the Mexicans: "Arrow-weed (*Yerba de flecha*). This is the name the shrub bears that produces the triangular seeds that during six or eight

months have a continual jumping movement. The shrub is small, from four to six feet in height, branchy, and in the months of June and July yields the seeds, a pod containing from three to five seeds. These seeds have each a little worm inside. The leaf of the plant is very similar to that of the 'garambullo,' the only difference being in the size, this being a little larger. It is half an inch in length and a quarter of an inch in width, a little more or less. The bark of the shrub is ash-colored, and the leaf is perfectly green during all the seasons. By merely stirring coffee or any drink with a small branch of it, it acts as an active cathartic. Taken in large doses it is an active poison, speedily causing death unless counteracted by an antidote."

Mr. Riley stated that the seed of *Tamariscus* was known to be moved by a Coleopterous larva (*Nanodes tamarisci*) that fed within it; and he concluded by describing and exhibiting a still more wonderful jumping property in a seed-like body which may be observed in our own woods. It is a little spherical, seed-like gall produced in large numbers on the under side of the post and other oaks of the white-oak group. This gall drops in large quantities to the ground, and the insect within can make it bound twenty times its own length, the ground under an infested tree being sometimes fairly alive with the mysterious moving bodies. The noise made often resembles the pattering of rain. The motion is imparted by the insect in the pupa and not in the larva state. Mr. Riley presented a description of the gall, which may be known by the name of *Quercus saltatorius*, the black fly which issues from it having been described as *Cynips saltatorius* by Mr. H. Edwards, of San Francisco.

THE PROGRESS OF DISCOVERY OF THE LAWS OF EVOLUTION.

AT a recent meeting of the Academy of Natural Sciences of Philadelphia, Professor Cope made some remarks on the progress of discovery of the laws of evolution, of which the following is a synopsis: —

He remarked that while Darwin has been its prominent advocate within the last few years, it was first presented to the scientific world in a rational form by Lamarck, of Paris, at the commencement of the present century. Owing to the adverse influence of Cuvier, the doctrine remained dormant for half a century, and Darwin resuscitated it, making important additions at

the same time. Thus Lamarck found the variations of species to be primary evidence of evolution by descent. Darwin enunciated the law of "natural selection" as a result of the struggle for existence, in accordance with which "the fittest only survive." This law, now generally accepted, is Darwin's principal contribution to the doctrine. It, however, has a secondary position in relation to the *origin* of variation, which Lamarck saw, but did not account for, and which Darwin has to assume in order to have materials from which a "natural selection" can be made.

The relations exhibited by fully grown animals and plants with transitional or embryonic stages of other animals and plants had attracted the attention of anatomists at the time of Lamarck. Some naturalists deduced from this now universally observed phenomenon that the lower types of animals were merely repressed conditions of the higher, or, in other words, were embryonic stages become permanent. But the resemblance does not usually extend to the entire organism, and the parallels are so incomplete that this view of the matter was clearly defective, and did not constitute an explanation. Some embryologists, as Lereboullet and Agassiz, asserted that no argument for a doctrine of descent could be drawn from such facts.

The speaker, not adopting either view, made a full investigation into the later embryonic stages, chiefly of the skeleton of the batrachia, in 1865, and Professor Hyatt, of Salem, Mass., at the same time made similar studies in the development of the ammonites and nautili. The results, as bearing on the doctrine of evolution, were published in 1869 in a paper entitled The Origin of Genera. (Proceedings of the Philadelphia Academy of Natural Sciences.) The relation usually observed between adult types and transitional stages was there termed *inexact parallelism.* It was then pointed out that the most nearly related forms of animals do present a relation of repression and advance, or of permanent embryonic and adult type, leaving no doubt that the one descended from the other. This relation was termed *exact parallelism.* It was also shown that if the embryonic form were the parent, the advanced descendant was produced by an increased rate of growth, which phenomenon was called *acceleration;* but that if the embryonic type were the offspring, then its failure to attain to the condition of the parent is due to the supervention of a slower rate of growth. To this phenomenon the term *retardation* was applied. It was then shown that the inexact parallelism is the result of unequal acceleration or retardation;

that is, acceleration affecting one organ or part more than another, thus disturbing the combination of characters which is necessary for the state of *exact parallelism* between the perfect stage of one animal and the transitional stages of another. Moreover, acceleration implies constant addition to the parts of an animal, while retardation implies continual subtraction from its characters, or atrophy. The speaker had also shown (Method of Creation, 1871) that the additions appeared either as *exact repetitions* of preëxistent parts, or as *modified repetitions*, the former resulting in simple, the latter in complex organisms.

Professor Haeckel, of Jena, has added the key-stone to the doctrine of evolution in his gastræa theory. Prior to this generalization, it had been impossible to determine the true relation existing between the four types of embryonic growth, or to speak otherwise than to the effect that they are inherently distinct from each other. But Haeckel has happily determined the existence of identical stages of growth or segmentation in all the types of eggs, the last of which is the gastrula, and beyond which the identity ceases. Not that the four types of gastrula are without difference, but this difference may be accounted for on plain principles. In 1874, Haeckel, in his Anthropogenie, recognized the importance of the irregularity of time of appearance of the different characters of animals during the period of growth, as affecting their permanent structure. While maintaining the view that the low forms represent the transitional stages of the higher, he proceeds to account for the want of exact correspondence exhibited by them at the present time by reference to this principle. He believes that the relation of parent and descendant has been concealed and changed by subsequent modification of the order of appearance of characters in growth. To the original, simple descent, he applies the term *palingenesis;* to the modified or later growth, *cœnogenesis.* The causes of the change from palingenesis to cœnogenesis he regards as three, namely, acceleration, retardation, and heterotopy.

It is clear that the two types of growth distinguished by Professor Haeckel are those which had been pointed out by the speaker, in The Origin of Genera, as producing the relations of exact and inexact parallelism, and that his explanation of the origin of the latter relation by acceleration or retardation is the same as that of the latter essay. The importance which Haeckel attaches to the subject was a source of gratification to the speaker, as it was a similar impression that led to the publication of The Origin of Genera in 1869.

It remains to observe that the phenomena of exact parallelism, or palingenesis, are quite as necessarily accounted for on the principle of acceleration or retardation as are those of inexact parallelism, or cœnogenesis. Were all parts of the organism accelerated or retarded at a like rate, the relation of exact parallelism would never be disturbed, while the inexactitude of the parallelism will depend on the number of variations in the rate of growth of different organs of the individual, with additions introduced from time to time. Hence it may be laid down that synchronous acceleration or retardation produces exact parallelism, and heterochronous acceleration or retardation produces inexact parallelism.

In conclusion, it may be added that acceleration of the segmentation of the protoplasma or animal portion of the primordial egg, or retardation of segmentation of the deutoplasma or vegetative half of the egg, or both, or the same relation between the growth of the circumference and centre of the egg, has given rise to the four types which the segmentation now presents. This analysis of the laws of evolution was tabulated as follows: —

		Exact parallelism produced by *palingenesis*, which is synchronous	*Inexact parallelism* produced by *cœnogenesis*, which is heterochronous
acceleration, which proceeds by	Exact repetition.	*	*
	Modified repetition.	*	*
	Heterotopy.	*	*
retardation, which proceeds by	Exact atrophy.	*	*
	Modified atrophy.	*	*

THE FLORA OF GUADALUPE ISLAND, LOWER CALIFORNIA.[1]

BY SERENO WATSON.

THE island of Guadalupe is in latitude twenty-nine degrees north, about one hundred miles from the coast of Lower California, and two hundred and thirty west of south from the town of San Diego, which is near the southern line of California. It is twenty-six miles in length in a north and south direction, with an average breadth of ten miles, and is traversed by a mountain ridge, the central peak (Mount Augusta) having an

[1] Extract from the Proceedings of the American Academy of Arts and Sciences, vol. xi.

elevation of 3900 feet above the level of the sea. From this point the nearest main-land is visible. The sides of the ridge are exceedingly rough and broken, cut up by numerous deep and rocky cañons, and even the more level surfaces are described as usually covered by rocks of every size and form. The rocks are volcanic, and several extinct craters still exist.

The island lies within the great ocean current which flows from the peninsula of Alaska down our western coast, the continuation of what is known as the Japanese Gulf-Stream, and in the zone of the northwest trade-winds. Fogs are very prevalent, especially in the winter months (from November to February), when they are driven by the winds over the crest of the island, covering all the northern end and filling the upper portions of the cañons, while the lower cañons and the southern extremity of the island remain clear and warm. These winter winds from the northwest are described as strong and cold, sometimes extremely so, an instance of which occurred during December, 1874, when ice an inch in thickness was formed in the middle of the island, accompanied by two inches of snow, which was followed by hail and five days of cold rain. In summer these winds have less force, though still brisk and chilly for much of the time; and the fogs, instead of being carried over the central ridge, are driven around the northern end, and by eddy-winds are borne into the lower cañons of the eastern side, which are thus made cooler than the region above them. Otherwise the summer months are intensely hot, especially in the southern portion of the island, and the soil becomes soon everywhere so dry that the effect of the temporary summer fogs upon the vegetation is slight. The difference in the seasons, however, at the two extremities of the island is remarkable, as vegetation at the southern end and in the eastern cañons is at least two months earlier than in the northern and western portions, and has for the most part reached its maturity by the close of May, under the then established heats of summer. The annual amount of actual rain-fall is very variable, there being an abundance in some years, and in others little or none.

Guadalupe was early known to the navigators of these seas, but it was never permanently occupied. There are evidences of its temporary occupation by shipwrecked sailors, and it was also long ago stocked with goats [1] for the purpose of supplying fresh meat to vessels short of provisions or suffering from scurvy, and,

[1] It is said that this was done by Captain Cook, who, however, was never upon this part of the coast. Vancouver passed near the island in 1793, but without stopping.

though out of the general course of travel, it has been occasionally visited on this account. Twelve years ago an expelled governor of Lower California took refuge here with his family, and remained for two years. Soon afterward a party of men from the same state lived for some months upon the island, engaged in killing the goats. During the last ten years it has been occupied by a California company, by whom it was purchased for the purpose of raising the Angora goat, and the island is now overrun by these animals. Several men are kept in continual charge of them, and regular visits are made by the vessels of the company.

With thus much of preliminary remark upon those conditions which must affect the vegetation of the island, we may pass to the flora itself. As respects the probable sources from which this flora may have been derived, it is evident that there has been abundant opportunity for the introduction of some species by human agency. These should be especially expected near the usual landing-place upon the eastern side, excepting such as would be probably distributed through the island by means of the goats. Those of most recent introduction in this way would doubtless be Californian; the older might be from the nearer peninsula or from other localities. Of other recognized agencies for the distribution of plants, — the winds, ocean currents, and birds, — the prevalent direction of the first from the northwest is adverse to the supposition that any species of phænogamous plants, at least, would be so introduced. The ocean currents might be considered as more favorable, and as likely to bring accessions from the Californian main-land, contributed from the interior by the Sacramento and other smaller streams. But the winds here again would prove an interposing agency, and by creating a surface-drift toward the coast would prevent floating seeds from attaining any great distance from it. Such as did succeed in reaching the island, and in obtaining and maintaining a foothold upon it, would probably be wholly Californian. Less certain conclusions might be expected in regard to the agency of birds, but it appears, from the collection of the birds of the island made by Dr. Palmer, that they are all in some measure peculiar to the island itself, "consisting almost entirely of familiar forms of the birds of the Western United States, but showing marked peculiarities, entitling them to recognition as geographical varieties. Nothing Mexican about them in the slightest degree."[1] So that, though

[1] Prof. Spencer F. Baird, in letter.

they demonstrate a connection between the island and California, yet they also indicate that that connection has been only at a remote period, and that their participation in the introduction of plants must have been slight.

It might therefore be conjectured, if the island were of comparatively recent formation and always disconnected from the main-land, that its flora would show a meagre list of species almost wholly Californian. Or if, on the other hand, it had at some time been connected with the continent, that then its vegetation would be similar to that of the adjacent peninsula, unless some counteracting influence should have been at work, as would seem to be true of the birds.

To show to what extent the flora of Lower California differs from that of California proper, reference may be made to the list of plants collected by Xantus at the lower extremity of the peninsula,[1] as given by Dr. Gray in the sixth volume of the Proceedings of this Academy. Of the one hundred and eighteen phænogamic species there enumerated, only six are probably found even in extreme Southern California, while thirty others range northward only as far as Sonora, or eastward through Mexico to New Mexico or Texas, the remainder being peculiar to the peninsula or exclusively Mexican. The peninsula shares in this difference with Mexico itself, the type of whose whole flora accords rather with that of the eastern portion of the continent northward, except so far as it would necessarily be affected by the more tropical character of the climate. Of this a good and sufficient illustration is seen in the fact that of the *Phaseoleæ*, a tribe which is well represented in all the Atlantic States, Texas, Southern New Mexico, Eastern Arizona, Sonora, Lower California, and all of Mexico southward, not one species is found within the limits of California, nor in the interior basin west of the Rocky Mountains.

The only collection that we have of the plants of Guadalupe is that made by Dr. Edward Palmer during the last season, from February to May, which is probably as complete as was possible, though attended with much labor and difficulty. He visited all parts of the island, often finding it necessary to reach places which the goats had found inaccessible, in order by means of ropes and poles to secure rare specimens of species which appeared to have

[1] The island of Guadalupe is equally distant from San Francisco and Cape San Lucas, but three degrees of latitude nearer to the latter point; and the difference of latitude between the cape and San Diego is little greater than that between Guadalupe and San Francisco.

been elsewhere completely extirpated. The entire number of species is one hundred and thirty-one, including one hundred and two exogenous and eight endogenous, the remaining twenty-one belonging to the higher cryptogamic orders, — ferns, mosses, and liverworts. Omitting a single phænogamous species (a *Heuchera*), of which the material is insufficient for a satisfactory determination, the remaining one hundred and nine may be divided into five groups: (1) Introduced species, of which there are twelve; (2) those that range from the Pacific to the Atlantic States, of which there are nine; (3) those that are found throughout California, or at least as far north as San Francisco, numbering forty-nine; (4) those found only in Southern California, below Los Angeles, or in Arizona, numbering eighteen; lastly, those peculiar to the island itself, of which there are twenty-one.

The twelve species[1] of whose comparatively recent introduction there can be little doubt are all of European origin, and chiefly from Southern Europe, and are all also found more or less widely naturalized in California. The original introduction of most is probably due to the Spaniards, at least upon the mainland, where the extent to which several have become distributed is something marvelous. The most remarkable is the Alfilaria (*Erodium cicutarium*), which, unlike the wild oat (*Avena fatua*), has not been limited in its range to the western side of the Sierra Nevada, but is found through much of the interior, from New Mexico to Washington Territory. On Guadalupe it is found everywhere, and is more abundant than any other plant. Another species of the same genus (*E. moschatum*), provided with the same contrivances for securing the dissemination and planting of its numerous seeds, occurs less frequently both here and in California; probably because, requiring more moisture, it is unable to maintain itself where the other will flourish. Another instance is the *Oligomeris subulata* of India, Egypt, and the Canary Islands, found also in Southern California, and common eastward through the valleys of the Lower Colorado and of the Gila to the Rio Grande, and in Northern Mexico. It is difficult to account for the wide-spread distribution of this plant, if of recent introduction, through a region so desert and sparsely inhabited.

Besides these twelve species placed in the first group, there are two others, also found in California, which are considered identi-

[1] *Brassica nigra; Oligomeris subulata; Silene Gallica; Malva borealis; Erodium cicutarium* and *E. moschatum; Sonchus oleraceus; Anagallis arvensis; Solanum nigrum; Chenopodium album; Avena fatua; Bromus sterilis.*

cal with South American forms (*Specularia biflora* and *Amblyopappus pusillus*), possibly introduced from Chili or Peru, perhaps indigenous to both regions. Their presence on Guadalupe would perhaps rather favor the belief that they are native to our western coast, especially as five other South American species, or forms of them, occur in the Guadalupe flora (*Jillæa minima*, *Gilia pusilla*, *Plantago Patagonica*, *Parietaria debilis*, and *Muhlenbergia debilis*), which are more or less frequent in California and eastward in the centre of the continent, and are generally admitted to be native. There are, therefore, ninety-seven phænogamous plants which may be considered as indigenous.

It is evident, therefore, that, as regards the species common to the island and the main-land, the flora may be said to be exclusively Californian in its character. Not a single species is found that is peculiar to Lower California or Mexico. The same alliance is nearly as prominent if we look at the twenty-one new phænogamous species of the island. Fifteen of these (a *Thysanocarpus*, a *Sphæralcea*, a *Lupinus*, a *Trifolium*, an *Œnothera*, a *Megarrhiza*, a *Galium*, a *Hemizonia*, a *Perityle*, a *Bœria*, a *Mimulus*, a *Pogogyne*, a *Calamintha*, a *Phacelia*, and an *Atriplex*) belong to genera largely or exclusively represented in California and the region east of it, and are mostly closely allied to the species of that region. The remaining six species include a *Lavatera*, a composite, a borraginaceous plant, a species allied to the olive, and finally a palm. The *Lavatera* is interesting as representing a widely scattered genus, not otherwise found in America, except as a second species occurs on the more northern island of Anacapa. The genus belongs chiefly to the region of the Mediterranean, where fourteen species are native; two others are confined to the Canary Islands; another has been discovered in Central Asia, and still another in Australia. The new composite is referred by Dr. Gray to a South American genus (*Diplostephium*), not otherwise represented in our flora, but of which there are eighteen species in the Andes from the equator southward. Of the borraginaceous and oleineous species Dr. Gray forms new genera; the one (*Harpagonella*) allied to the small genus *Pectocarya*, of which there is one Chilian species and two Californian, one of these also in the Guadalupe flora; the other (*Hesperelæa*) bearing no close resemblance to any other member of the olive family. On the other hand, the palm (*Brahea* (?) *edulis*), conspicuous on the island as the only representative of a tropical flora, is probably less nearly related to

the Central Mexican genus to which it is provisionally referred, than to the genus *Livistona* of Australia. A congener of the Guadalupe species has recently been detected by Dr. Palmer in the cañons of the Tantillas Mountains, near San Diego. . . .

As respects the cryptogamic vegetation, of the half a dozen ferns, all are frequent in California, one peculiar to the southern part of the State, another found throughout North America and Europe. Of the eleven mosses, two are strictly Californian species, seven are common everywhere in the United States and Europe, and two are European species which had not previously been detected in America. Of the four *Hepaticæ*, three are Californian and one is considered new.

Reference should be made to the plants which by their abundance and prominence give character to the vegetation. Among these the "sage-brush" and "grease-woods" of the valleys of the basin are duly represented by an *Artemisia* and an *Atriplex*, which share with a *Franseria* in covering large tracts, and in protecting the soil and the smaller annuals from the winds and sun. Trees are numerous over much of the island, chiefly coniferous: a pine, belonging to a Southern Californian species, but peculiar in some of its characters; a juniper, common in California; a cypress, similar to and perhaps identical with a Mexican species which extends into California; and a small oak, which is common throughout the State. To these is to be added the palm, which is frequent in the southern cañons, growing to a height of forty feet, and bearing large clusters of edible fruit.

To conclude, it is apparent, from all that has been said, that this little flora as a whole is to be considered a part of that of California, as distinct from the flora of Mexico. It may be inferred also that it has not been to any great extent derived from California by any existing process of conveyance and selection, but that it is rather indigenous to its present locality. Moreover, while it would indicate a connection at some period between the island and the main-land to the north, yet the number and character of the peculiar species favor the opinion that they are rather a remnant of a flora similar to that of California, which once extended in this direction considerably to the southward of what is now the limit of that flora upon the main-land. And, finally, the presence of so many South American types suggests the conjecture that this, and the similar element which characterizes the flora of California, may be due to some other connection between these distant regions than any which now exists, and even that

all the peculiarities of the western floras of both continents had a common origin in an ancient flora which prevailed over a wide, now submerged area, and of whose character they are the partial exponents.

RECENT LITERATURE.

Huxley and Martin's Biology.[1] — The problem which has so frequently puzzled teachers in biology, namely, to know where to commence their instruction, has been most happily solved by Professor Huxley in his Elementary Biology. He has prepared a series of practical lessons which should be mastered by all who wish to lay a solid foundation upon which to build special knowledge in either zoölogy or botany.

The plan followed by Huxley has been to take a small number of plants and animals readily obtainable under ordinary circumstances. Of these a short description is given, followed by detailed laboratory instructions; these should enable every student to know from his own knowledge the facts mentioned in the accompanying description. He will thus gradually learn biological terms, and obtain "a comprehensive and yet not vague conception of the phenomena of life." The plan of thus paving the way to special study by careful, practical work on a few forms is not a new one. The elder De Candolle used to say he could teach all he knew of botany from a few plants, while zoölogists until recently gained their first insight into the phenomena of life mainly from the study of vertebrates, and especially of man. It is only within a more recent period that the great development given to the study of invertebrates has trained a school of zoölogists who have begun at the lower end, so to speak, and who have always retained their predilection for invertebrates in opposition to those who, having studied human anatomy and physiology, have mainly devoted themselves to the vertebrates. The latter have always worked with the immense advantage of attacking their subject with knowledge gained in a field where the constants of the science, contrasted with those known from among invertebrates, were numerous, and where the beginner never stumbled at the outset of his investigations across structural features and phenomena most imperfectly understood.

It is greatly to be hoped that the introduction of such an admirable text-book as that of Huxley and Martin will not only break down the distinction existing between the two sections of zoölogists, but will also lead zoölogists and botanists hereafter to become biologists, while following the special department to which they may from inclination devote themselves as original observers.

[1] *A Course of Practical Instruction in Elementary Biology.* By Professor Huxley and H. N. Martin. Crown 8vo. 6s. London and New York: Macmillan & Co. 1875.

This book is quite unique for a text-book on biology; it has not a single figure. The student is called upon from the instructions to see first for himself what there is to be observed, then to make his own drawings, a process which will surely and clearly show him, or his teacher, what he has omitted. The student has no possible chance, in giving an account of what he has done, to repeat anything by rote, for should he follow the usual practice of reciting the very words of the description, he can hardly hope to give an intelligent reply to the questions of his teacher, if the latter is properly fitted to guide him in his laboratory work. The amount of solid information to be obtained by faithfully following the instructions given for the study of the frog shows the masterly hand which has prepared the questions.

The total absence of discussion of any sort is as remarkable a feature in this volume as the omission of all figures.

WHITE'S NATURAL HISTORY OF SELBORNE.[1] — Reading again this delightful record of quiet, shrewd observations of the habits of birds and crickets, trees and plants, sticklebacks and hedgehogs, — in fact, the common things of the wayside and hedgerow, — by an English country curate, we have renewed the delights of our boyhood, when White's Selborne, Sandford and Merton, and the Swiss Family Robinson were the standard books. But what a contrast this gorgeous edition to the little buff paper-covered reprint in Harper's Family Library!

To the letters of White to Thomas Pennant, Esq., whose name is so indelibly connected with American zoölogy, and to the "Honourable Daines Barrington," are added some hitherto unpublished, a memoir of the author, and over a hundred pages filled with a strange medley of notes by Frank Buckland, the editor of the volume, illustrated by cuts of man-traps, a baby hedgehog, a mummied monkey, and other objects, as a rule more grotesque than useful, while Lord Selborne contributes some notes to the Antiquities.

The illustrations by Delamotte are exquisite and abundant, and the work is published in a style of elegance and luxury that will, we feel sure, lead many a country gentleman in America as well as England to give it a conspicuous place on his drawing-room table.

ANDERSON'S NORSE MYTHOLOGY.[2] — So much has been said in praise of this book by scholars that we can add nothing by way of commendation or criticism that will be of any importance. But aside from its literary merits, and the interest that so fresh, enthusiastic, and apparently

[1] *Natural History and Antiquities of Selborne.* By GILBERT WHITE. With Notes by FRANK BUCKLAND, a Chapter on Antiquities by LORD SELBORNE, and new Letters. Illustrated by P. H. DELAMOTTE. London: Macmillan & Co. 1875. 8vo, pp. 591. $12.00.

[2] *Norse Mythology; or, The Religion of our Forefathers.* Containing all the Myths of the Eddas, systematized and interpreted. With an Introduction, Vocabulary, and Index. By R. B. ANDERSON. Chicago: S. C. Griggs & Co.; London: Trübner & Co. 1875. 12mo, pp. 473. $2.50.

reliable a study of Norse mythology possesses, the book, it seems to us, will prove of lasting value to the student of comparative mythology. If the Norsemen originally came from Asia, we have in this recent folk lore a descendant of a fossil mythology, and a means of comparison with the mythology of our American aborigines. When the time comes for a comparative study of our Indian traditions and legends, we may be able to discover some connection with the archaic myths of the Indians of the Old World which will throw some light on the origin of human life on our continent.

RECENT BOOKS AND PAMPHLETS. — A Romance of Perfume Lands, or the Search for Capt. Jacob Cole. With Interesting Facts about Perfumes and Articles used in the Toilet. By F. S. Clifford. Boston: Clifford. 1875. 12mo, pp. 295.

On the Superficial Geology of the Central Region of North America. By G. M. Dawson. (From the Quarterly Journal of the Geological Society, London, November, 1875.) 8vo, pp. 603–623.

La Maturation de l'Œuf, la Fécondation, et les premières Phases du Développement embryonnaire des Mammifères, d'après des Recherches faites chez le Lapin. Communication préliminaire. Par Édouard Van Beneden. Bruxelles. 1875. 8vo, pp. 53.

The Present Condition of the Earth's Interior. By Geo. F. Kittredge. Buffalo. 1876. 8vo, pp. 16.

First Annual Report of the Chicago Botanical Garden, December 1, 1875. Chicago. 1876. 8vo, pp. 4.

GENERAL NOTES.

BOTANY.[1]

THE PLANTAIN INDIGENOUS IN SOUTHERN COLORADO. — While with Holmes's division of Hayden's survey last summer, in Southwestern Colorado, I found the common dooryard plantain under such circumstances as to render it probable that it is indigenous there. With the exception of a few plants growing in a grass-plot where it was no doubt sown with eastern grass seed, I have never met with it in Eastern Colorado. Near the corner of the four Territories, on the sand-bars of the Rio Dolores and Rio de los Mancos, a part of Colorado inhabited only by Navajoes and Utes, it is quite common. This almost unknown region has rarely been visited by the white man, and the plant could not have been introduced by him. — T. S. BRANDEGEE.

VITALITY OF SEEDS. — Professor Ernst, of Caracas, contributes the following facts to this vexed subject. The Plaza Bolivar in Caracas was formerly a market-place, and until the year 1867 formed a square plain inclined from north to south. When the government decided to remove the market and use the grounds as a park, the place was leveled by digging away about six feet of the soil at the northern end. Of course a fresh surface was thus exposed to the air. A large number of rubbish

[1] Conducted by PROF. G. L. GOODALE.

plants or very coarse weeds soon clothed the earth from which the six feet of soil had been taken. But among the many plants which came up at the northern end of the plaza was a vast quantity of *Broteroa trinervata*, a species which is very restricted in its range near the city. The only locality from which the fruits of this plant could have been brought by the wind was south of the plaza; but on account of the surroundings of the city, south and north winds are unknown. It seems likely to Professor Ernst that the seeds had remained under the cement of the old market-place for more than thirty years, and had been there preserved unharmed. When the cement was broken up and the ground graded for the plaza, the buried seeds, or rather fruits, were exposed to atmospheric influences, to moisture, warmth, and air, and after the lapse of so long a time germinated.

The second case relates to a very common weed, shepherd's-purse, which, strange to say, is so rare at Caracas that it had not been met with in botanical excursions covering a period of twelve years. Two years ago, in the southern part of the garden of the monastery a place was graded for the erection of a building. A great deal of soil was removed and a wholly fresh surface was thus uncovered. Upon this spot many weeds sprang up, and among them thousands of specimens of *Capsella bursa-pastoris*, or shepherd's-purse. Professor Ernst concludes that in this case, as in the other, the seeds had remained dormant in the soil for an unknown period. These cases belong to the same class as those mentioned by Hoffmann, and given in the January number of the NATURALIST.

TROPICAL TREES DURING THE DRY SEASON. — Professor Ernst, of Caracas, states that many woody plants of the Venezuela flora lose all their leaves during the dry season, even when the ground is copiously watered for the purpose of preventing their fall. Several large-leaved plants, such as *Cassia*, mahogany, and many others, exhibit this phenomenon. The new foliage starts usually when the rainy season sets in, but if the rains come very late, as they did in 1875, many of these trees unfold their buds and develop the leaves at a period when the ground is dry and hard, the tropical heat very intense, and the air extraordinarily dry. This curious periodicity has been casually noticed by several writers, but no explanation has been hitherto offered. Professor Ernst has given this subject careful study, and now states that in general, those trees which cast their foliage in the dry season have compound leaves of rather delicate texture. From such leaves transpiration is exceedingly rapid, and early carries away all the available water. When there is no more moisture within reach of the plant, the leaves separate from the stem. In this wholly or partially leafless condition the trees remain until the end of April or the beginning of May, when the moist winds from the northwest, as precursors of the tropical rains, awake the slumbering vegetation. Of course the trees cannot absorb by their parts

above ground any great amount of moisture, if they do any at all, but the slight transpiration which had been going on from stems and young shoots is now checked. The small amount of moisture which the roots can take from the parched soil is not without speedy effect upon the branches and buds to which it is carried. The buds soon open. But in the spring of 1875, when there was not a cloud to be seen in May, and the west wind at evening brought little relief from the scorching drought of the day, and the baked crust of the soil everywhere showed no trace of moisture, the trees put forth their leaves as usual! Now the first case is easily explained; how about this one, which seems so different?

At the outset, Professor Ernst admits that the individual nature of the plant, the age, the condition as regards health, etc., must be carefully investigated. This he has not yet done. He goes on, however, to say that it is generally understood that the only external excitant to growth is the warmth of the air. Since in the dry season there is, as he states, a difference between the temperature in the sunlight and at night of about twenty-seven degrees Fahr., this must cause very great changes in the volume of the gases held in the spongy tissues of the tropical trees. The pressure is very variable, and he assumes that the fluctuations must cause motions of nutrient liquid. He further assumes that when these juices are brought to the terminal cells of a bud, growth must result, and the leaves must unfold. It must be confessed that Professor Ernst has made a fair use of Krutzsch's observations in regard to the temperature of stems and twigs as affected by the surrounding temperature, and he appears to have skillfully applied the mechanical theory to this case, but he has not as yet done much to solve the riddle of periodicity of vegetable rest.

ECCENTRICITY OF THE PITH OF RHUS TOXICODENDRON. — My attention was drawn to this subject by the January NATURALIST. As is well known, this handsome but much-dreaded climber, so common in all our woodlands, has the habit of adhering tightly to the trees which it ascends by a multitude of aerial rootlets, which often cover its stem and give it the appearance of being embedded in a cushion of moss.

The results of my investigations on the stems of this plant are somewhat curious. The fact itself that the pith, wherever the vine is found adhering closely to living trees, lies very near the outer side, leaving a largely disproportionate amount of the woody tissue on the side next the tree, is, so far as I have observed, universal. The following observations will give an idea of this disproportion: —

In a vine $5\frac{1}{2}$ lines in diameter the distance from the centre of the pith to the inner margin was $4\frac{3}{4}''$, and to the outer only $\frac{3}{4}''$. This proportion held uniformly for various heights from the ground. The measurements included the bark, which, as well as the annual rings, partook of the general tendency, and was much thinner on the outer side.

A larger vine, upwards of an inch in diameter at the base, had climbed

a cedar-tree (*Juniperus Virginiana* L.) to the top, and, no longer finding anything to adhere to, sent out free fruiting branches nearly half an inch thick. Of this I took several measurements. Two and a half feet from the ground, where the diameter was 10½″, the distance from centre of pith to inner edge was 8½″, and to outer 2″. A foot lower the proportion had decreased to that of 9″ to 2½″ in a diameter of 11½″. Ten inches lower still it had further decreased, so that the pith was still 9″ from the inner, but 4½″ from the outer margin. The ratios between the two distances in descending the stem were therefore, respectively, 4¼, 3⅗, and 2. Above the first-mentioned point the position of the pith remained nearly unchanged.

A very large vine, nearly four inches in diameter, gave less marked results. Sections not being exactly circular, linear measurements could not be relied upon, but a line drawn through the heart, parallel to a tangent at the point of contact with the tree to which it adhered, showed a decided preponderance of wood in the inner segment. The adhesion in this case, however, as is probably the case with all large vines, was slight, the rootlets appearing to lose their vitality with age. The vine divided at the height of eight feet, and the branches, which adhered more closely, showed a greater eccentricity.

Numerous observations were made on other vines thus normally situated, with substantially the same results. One case in particular, however, exhibited the extreme of the phenomenon, the cellular dot approaching to within a fourth of a line of the membranous bark. Indeed, so anxious did it seem to remove itself to the greatest possible distance from the tree that for the greater part of the way there was a manifest ridge running along the back of the stem, in which the pith was situated.

These facts, however, uniform and singular as they are, could not in themselves be regarded as sufficient to demonstrate the absorption of sap from the supporting trees by the rootlets. To satisfy such an assumption certain tests must be applied. The first that suggested itself to me was that of making similar observations at points where, for any reason, the vines had swung loose from their support, so that no connection should exist by means of the rootlets. Many such cases were found and examined. The larger vine first referred to, which at a distance of two feet and a half from the ground, where the attachment was firm, measured 8½″ to the inner and 2″ to the outer margin, giving a ratio of 4¼ between the measurements, had the pith located 5¼″ from the inner and 3¾″ from the outer margin, a ratio of 1⅖, at a point some six feet higher, where it had become detached. In this example it was evident that there had formerly existed some degree of attachment. At other points higher up, where there were less signs of its having ever adhered, the pith was found to be nearly central, while on the projecting branches of the same vine, bearing the berries and showing no tendency to cling, there was no appreciable eccentricity. Another small vine, which ad-

hered for four feet and then swung away for two feet, reattaching above, had the pith decidedly more central at the detached part than at points either above or below. The extreme case to which I referred, where the pith actually ran through a tube slightly raised above the outer surface, showed a transition from this state of extreme eccentricity to one of centrality in the space of one foot where the vine suddenly abandoned its support.

The function assigned to the rootlets by the hypothesis is one of parasitism. They are assumed to penetrate the bark as far as the cambium layer, and remove the sap of the tree, appropriating it directly to the vine. This nutrition, being ready-made, would naturally be deposited at the nearest point of contact, and thus account for the great preponderance of woody tissue found on the side next the tree. It would therefore follow that this eccentricity of pith should not exist where the support is not a living tree. To test this question, I sought out a small vine of the same species which climbed and closely adhered with a profusion of rootlets to a perfectly dry stone wall ten feet in height. This I examined most carefully, and accurately measured at various points, finding the position of the pith uniform at all distances from the ground. The following measurement will therefore answer for all: Three feet from the base, where the diameter was $4\frac{3}{4}''$, the pith was $2\frac{3}{4}''$ from the inner and $2''$ from the outer edge, or within three fourths of a line of the centre.

One other class of instances seemed to bear directly on this point, and to these I gave special attention. I refer to vines found climbing fences and posts under varying circumstances. The results obtained from these were perhaps the most surprising of all. One $5\frac{1}{4}''$ in diameter tightly hugged a decayed fence post, insinuating its rootlets deeply into the soft surface. Of this the pith was $4''$ from the inner and $1\frac{1}{4}''$ from the outer margin, giving the astonishingly large ratio of $3\frac{1}{5}$. A section of a larger stem ($11''$) similarly situated, and whose rootlets tore away considerable of the decayed wood in detaching it, showed the centre of the pith to be $7''$ from the inner and $4''$ from the outer margin. Considering the size of this vine the eccentricity was large.

Where the wood to which the vines adhered was not decayed or soft, a marked diminution in the eccentricity was perceptible. In one instance where the rootlets clung very tightly to a dry surface, which had moreover been charred and where penetration was impossible, the measurements were respectively $3\frac{1}{2}''$ and $2\frac{1}{2}''$, or an eccentricity of half a line in a diameter of half an inch.

So far as my observations, which were numerous, extended, it seemed to be the law that, *cæteris paribus*, the softer the wood to which the rootlets adhered, the greater the eccentricity of the pith.

Without going further into details, therefore, the whole subject may be thus briefly summed up: —

(1.) The pith of the poison ivy, wherever the vine is of moderate size, and is found adhering closely either to the bark of a living tree or to any soft, decaying substance, is located from three to ten times nearer the outer than the inner side of the stem, and sometimes still more eccentrically; the annual layers of wood as well as the bark becoming correspondingly thickened on the side next the support.

(2.) This eccentricity diminishes and frequently disappears altogether at points where there is no attachment by the rootlets.

(3.) It is greatly reduced in vines which cling to hard substances which the rootlets are unable to penetrate, as a stone wall or a dry post.

That all these facts are in harmony with the theory of the absorption of nourishment from the support, in so far as any form of parasitism is implied, cannot of course be maintained. The last class of observations described may be regarded as directly negativing such an assumption. Besides, I have seen nothing to render it probable that the rootlets ever pierce the outer bark. But, on the other hand, these facts do all unite in pointing to a physical connection of some kind between the penetration of the rootlets and the eccentricity of the pith. The notion thus far entertained, and which has found its way into our standard text-books, that these rootlets are "not for absorbing nourishment, but for climbing,"[1] may in future require some modification. Yet, admitting this physical connection, there remain puzzling physiological questions. If these rootlets perform the function of true roots, and find congenial soil in the corky layer of bark, in the soft mass of decomposed wood, and even to some extent in the minute cryptogamic vegetation that always exists among them even when clinging to walls of brick or stone, how does this explain the singular behavior of the pith and the strange eccentricity of the annual rings? — Lester F. Ward.

Sets of Dr. Edward Palmer's recent collection of plants of San Diego Co., California, and of the Tantillas Mountains in Lower California, near the boundary, will shortly be ready for distribution. They will probably number about three hundred species, and will be sold at ten dollars per hundred. Address Sereno Watson, Cambridge, Mass.

Robinia hispida. — Can any of our readers procure specimens of *the fruit* of this plant for Professor Gray, of Harvard University, Cambridge? The pods are almost unknown.

Botanical Papers in Recent Periodicals. — *The Journal of Botany* (Trimen), February. S. Kurz, On the Species of *Glycosmis* (plants of the orange tribe). A. E. Eaton, Plants of Spitzbergen. H. F. Hance, New Orchids from Hong Kong. Reichenbach fils, Descriptions of three Plants. W. B. Helmsley, Notes on the Flora of Sussex. R. A. Prior, On *Rumex hydrolapathum* and *R. maximus*. G. Dickie, On Marine Algæ from Kerguelen Island. M. J. Berkeley, On a New Agaricus from Kerguelen Island. Dr. Gray's paper on Æstivation and its Terminology is reprinted in this number.

[1] Gray's Lessons, page 34.

Comptes rendus, January 3d. Duchartre, Conclusions respecting the Production of Saccharine Matters in Plants. E. Heckel, Floral Glands of *Parnassia palustri.* January 10th. R. Corenwinder, On the Diminution in the Amount of Sugar in Beets, during the Second Period of their Growth.

Annales des Sciences naturelles, December, 1875. P. Duchartre, On the Bulbs of *Lilium.*

Flora, No. 33. Dr. Lad. Celakovsky, On Intercalated Epipetalous Stamens. F. Arnold, On the Lichens of the French Jura. Nos. 34 and 35. C. Müller, New Grenada Mosses. Dr. K. Prantl, Morphological Studies. No. 36. O. Böckeler, On certain Carices. This number contains a very long and interesting review of Darwin's Insectivorous Plants. No. 1. Hugo de Vries, On the Wood formed during Repair of Wounds in Trees.

Botanische Zeitung, No. 2. On the Palmella State of *Stygloclonium*, by L. Cienkowski. On the Influence of Light on the Color of Flowers, by E. Askenasy (elsewhere noticed). No. 3. Botanical Miscellany, by Dr. A. Ernst (abstracts of these notes are given above). On the Behavior of Yeast in Liquids free from Oxygen Gas, by M. Traube (controverting the views of Brefeld). No. 4. The Development of *Basidiomycetes*, by Oscar Brefeld. (A review of some recent publications, especially those of Reess and Van Tieghem.) No. 5. Investigations respecting Growth, by J. Reinke (not finished). On the Rate of Movement of Water in Plants, by Dr. Pfitzer (to be hereafter noticed). In the report of the Bonn society, Professor Pfeffer's papers on the Formation of the Primordial Utricle, and the Production of High Hydrostatic Pressure by Osmosis, previously noticed in this journal, are given with considerable fullness. No. 6. On the Morphology of the Araceæ, by Dr. A. Engler (not finished).

ARBEITEN DES BOTANISCHEN INSTITUTS IN WÜRZBURG, herausgegeben von Professor Dr. Sachs. Erster Band. This volume of contributions from the Botanical Institute at Würzburg comprises four parts, which have appeared at nearly regular intervals since 1871. The work can therefore be ranked among periodicals. In the present notice we shall give very briefly a sketch of the memoirs, hoping to present fuller outlines of several of them in subsequent numbers of the NATURALIST. 1. Dr. W. Pfeffer, On the Action of Colored Light on the Decomposition of Carbonic Acid in Plants. (By an improved method of research the following results were reached: Only the visible rays of the spectrum can decompose carbonic acid; in fact, those which seem brightest, namely, the yellow rays, are alone as efficient in this work as all the others combined. The most highly refrangible rays of the visible spectrum, and those which act most energetically on chloride of silver, etc., play a subordinate part in assimilation. Each color in the spectrum has a definite quantitative effect on the activity of assimilation.) 2. Dr. W.

Pfeffer, Studies respecting Symmetry and Specific Causes of Growth. (An examination of the influence of surroundings upon the growth of a liverwort.) 3. J. Sachs, On the Influence of the Temperature of the Air and the Effect of Daylight on the Periodical Changes in the Rate of Growth of Internodes in Length. (See abstract in Sachs' Text-Book, page 735 *et seq.* In the memoir, Professor Sachs has given a very full *résumé* of the literature of the subject.) 4. J. Sachs, On Negative Geotropism. (Observations respecting the curving upwards of shoots from a stem placed horizontally.) 5. J. Sachs, On the Deflection of Roots from their Normal Direction of Growth by Contact with Moist Surfaces. (See abstract in Sachs' Text-Book, page 764.) 6. Hugo de Vries, On some Causes of the Direction taken by Parts or Plants which possess Bilateral Symmetry. (The effects of gravitation, light, defoliation, etc., are examined. The views of Frank are contested. See Text-Book, page 705.) 7. J. Sachs, The Plant and the Eye as Different Tests for Light. (Sachs had early insisted upon a distinction between objective intensity of light and its brightness to the eye. Prillieux in a paper on the subject is thought to have overlooked these distinctions, as well as that between refrangibility (objective) and color (subjective). In the present memoir Professor Sachs reviews the literature of the subject, defends his former position, and further explains the relation between the intensity of light and the activity of assimilation.)

ZOÖLOGY.

The Crossbill breeding at Riverdale, N. Y. — This bird (*Loxia curvirostra* var. *Americana*) made its appearance here last autumn, November 3d. Small flocks were occasionally seen all winter, and through March and April, feeding on seeds of cones of the Norway spruce and larch. On April 22d I noticed a pair building near the top of a red cedar, about eighteen feet from the ground. The nest, April 30th, contained three eggs, and was composed of strips of cedar bark, dried grass, and stems of the Norway spruce, and was lined with horse-hair, feathers, dried grass, and fibrous roots. The eggs were about the size of those of *Junco hyemalis*, in color very light blue, slightly sprinkled and blotched at the large end with dark purple. I saw a small flock of six of these birds May 10th, which were the last seen here. Riverdale is on the Hudson River, sixteen miles north of New York Bay. — E. A. Bicknell.

Bewick's Wren (*Thryothorus Bewicki*), although not a well-known bird to those not ornithologists, is not "something of a rarity" in the middle Atlantic States, as stated by Dr. Coues in the January number of the Naturalist. I have not failed to find considerable numbers of them for several years past. They appear to have a strong attachment for certain localities, and, if undisturbed, will return year after year to

the same spot to breed. An interesting feature in the habits of this species is the marked variation of their vocal powers. While some are remarkably fine singers, others are very commonplace, or else too lazy to exercise their capabilities. — CHARLES C. ABBOTT, M. D., Trenton, N. J.

FLOWERS OF THE GOLDEN CURRANT PERFORATED BY HUMBLEBEES. — In Part 7 of Half-Hours with Insects, page 202, it is stated that the first and only instance known in this country of the curious trait of the humblebees of perforating the corollas of flowers to get the honey is given by Mr. W. W. Bailey in THE AMERICAN NATURALIST, 1873.

Last spring a cluster of *Ribes aureum* growing in my dooryard was visited by humblebees, and I noticed that they always extracted the honey through perforations in the bases of the calyces made by their mandibles. When at least three fourths of the flowers had been despoiled in this way, so great was their dexterity that seven flowers per minute were found bitten open and robbed of their honey. The same was noticed by Mr. Struthers, of Fort Atkinson, on the flowers of *Robinia pseudacacia*, in 1863. — W. F. BUNDY.

HABITS OF WESTERN BIRDS. — As we encamped on Antelope Creek, Nevada, May 28th, I at once proceeded to procure specimens, and in following up the stream a short distance I came upon a thicket of willows, in which I found a large nest, occupied by one of the parent birds. After securing the bird, which proved to be the female of *Buteo Swainsoni*, and crawling up to the nest for the eggs, I noticed a slight commotion amongst the leaves but a short distance away, which upon examination proved to have been caused by a pair of Bullock's orioles (*Icterus Bullockii*), which were also breeding. Both of these nests were about twelve feet from the ground, only eight feet apart, and unprotected from above, by the absence of any branches or leaves. The orioles had certainly built in a dangerous locality, and must have been entirely unmolested by the hawks, as the eggs in both nests were far advanced in incubation.

Later in the season (August) we camped at Big Pines, Owens Valley, Cal., where we saw great numbers of humming-birds flying around the tops of the pine-trees. Towards evening some were seen near the ground, and after watching them very closely for a while I saw one alight close by, which soon after flew to its nest. The nest was built upon a small cottonwood branch, exactly over and but about two feet above a perfect torrent of water rising in the glacial summit of the Sierra Nevadas. The species (as Professor Baird has since informed me) was *Stellula Caliope.* The nest, eggs, and skins, with those above referred to, are now at the Smithsonian Institution, together with the general collections.

In the December number of the NATURALIST for 1873, Mr. Allen answers Dr. Barrett (?) in reference to the supposed geographical "distribution," or rather range, of the crow and raven. As he says, they are

gregarious throughout the region over which we passed in 1873, Yellowstone River, etc., and I can say the same of Nevada, in the valley of the Payhee and Humboldt rivers. Frequently, while working our way slowly up the Grand Cañon of the Colorado River, where the plateau was over six thousand feet above us, with walls at an angle (from base to summit) of nearly eighty degrees, we found numbers of crows and ravens flying over our heads, or perched upon the projecting ledges of sandstone or basalt. Rather dismal to hear the croaking in such a locality, — the bottom of a gorge, one and a quarter miles below the surface. — W. J. HOFFMAN, M. D.

REMARKABLE STRUCTURE OF YOUNG FISHES. — Dr. Günther, of London, has recently discovered that the young of the sword-fishes and *Chætodus* possess structures exceedingly different from that of the adult. In the young *Chætodus* the front of the body is shielded with large bony plates, which in one species are produced into three long, equidistant horns, which diverge ray-like from the body. In the sword-fishes the scapular arch is prolonged into a horn at the lower part, and the belly fins are wanting. There is no sword, but the jaws are long, of equal length, and both are furnished with teeth. As the fish grows, the scapular horn disappears, the ventral fins grow, and the upper jaw is developed in excess of the lower. The long teeth disappear, and the upper jaw grows into the toothless, sword-like weapon which gives the fish its peculiar character.

UNUSUAL NESTING SITES OF THE NIGHT HAWK AND TOWHEE BUNTING. — A letter from Mr. William Couper, of Montreal, speaks of his having found the eggs of *Chordeiles popetue* on the flat roofs of buildings in that city, and the nest of *Pipilo erythrophthalmus* in a small tree about three feet from the ground. In each of these cases the departure from the usual habit of the species is decided. — ELLIOTT COUES.

EGGS OF BOA-CONSTRICTOR. — My friend, Dr. Kunzé, has shown me an infertile egg of a boa which he lately obtained at the Central Park menagerie. The boa laid twenty-one eggs, each about the size of a hen's egg. The animal made the deposit in sight of her keeper and others. She laid two fertile eggs, and then a sterile one, in regular succession; each third egg was sterile. The fertile eggs had each a young boa within. One came out of its shell immediately after being laid, but soon died. All the others died within their shells. The sterile eggs were albuminous throughout, and cut like cheese and smelled like sperm oil. Could this be the balance of an impregnation received the year before? — S. LOCKWOOD.

SMALL BIRDS CAUGHT BY THE BURDOCK.— At Lake George, a gentleman presented me with a skeleton of a humming-bird, firmly fastened to some burs, which he found on a burdock; and at the same time he found a live one on a plant near by. I was walking along one of our country roads, when I saw a yellow-bird (*Chrysomitris tristis*) fluttering

on a burdock, and when I stooped to catch it, it tore itself away, leaving a number of its feathers on the burs. A few days after, I caught a yellow-rumped warbler (*Dendroica coronata*) fastened to the same kind of plant. — A. K. Fisher.

ANTHROPOLOGY.

Anthropological Notes. — Those who attempt to institute a comparison respecting the elaboration of culture in the Old World and in the New, and to sum up the contributions of nature in the two hemispheres, must not forget that in the western men wrought only with their hands, that they had the service of not a single tractive animal, of no beast of burden excepting the llama, that they had no cows for milk, no domestic animals for slaughter; and but for the faithful wolf-dog, the aborigines of North America would have been absolutely cut off from the advantages of those friends of man which in the eastern hemisphere are indissolubly linked with progress.

The railway companies of Western Germany having taken steps to secure and preserve all historical and prehistorical relics found in their gradings, some rich discoveries have been their reward. At Durkheim a highly ornamented Roman tripod inlaid with gold and other metals was found. Near Eisenberg, a Roman grave with rich deposits was opened.

Prof. George Rolleston's paper in the *Journal of the Anthropological Institute* (v. ii. 120), On the People of the Long Barrow Period, is a very interesting treatment of the subject. We can extract only a few sentences. As to the physical characteristics of the people, the male skeletons were very generally about 5.5 feet, the female 4.8 feet. The average difference between the statures of males and females in civilized races is about half this amount, while a precisely similar disproportion is observable at the present day in the stature of individuals of the two sexes among savages. In studying the skulls we are to take into account what the author, quoting Professor Cleland, calls "ill-filledness," or the presence of ridges and depressions occasioned by scanty feeding and lack of comfort. Speaking of the age of the barrows, there is no doubt that they are the first sepulchral evidences of the existence of man in Britain. Pristine or priscan man, like the modern savage, grudged no labor less than that which was spent in piling up a huge mound. Mr. H. W. Mosely, naturalist to the Challenger, in recording his observations on the Kudang tribe of Australia, living near Cape York, says that though they are destitute of almost everything in the way of property, having neither perforated stones to help them dig roots, as have the Bushmen, nor boomerangs, nor tomahawks, nor canoes; living not on the available wallabies and phalanges, but on fish, reptiles, invertebrates, and vegetables; having the scantiest clothing; being, finally, below savagery, as understood by a good judge of it, Professor Nillson, in having no

chiefs, — they nevertheless take great pains with the burial of their dead, marking out and adorning the graves with posts, and decorating them with the bones of the dugong. None of them have any metal implements; tanged and barbed arrowheads are wanting in them. When containing any burnt bones, the latter never occur in urns, and a large proportion of the bones present the manganic oxide discoloration. The immense majority of long barrows in the south of England were erected for inhumation, whereas exactly the reverse has been the rule in the north counties.

On the whole, indications are not wanting which suggest that inhumation will ultimately be shown to have been the earliest mode of burial practiced in these as yet the earliest known sepulchres, and that inhumation in galleried chambers was probably the earliest variety practiced, at least where the necessary slabs of such chambers and passages were available, but that burial without burning, and also without any cist or chamber whatever, may in other districts not so conditioned have been contemporaneous with burial in chambers; and, finally, that inhumation in cists without passages leading down to them, and cremation, mark later epochs in the Long Barrow Period. The plan of cremation was that of packing the bodies in all states of decomposition along the central axis, together with wood and stones; the combustible and transpirable mass reached half the length of the barrow. Whatever was done in a cremation barrow was done at one time, once and for all.

Macmillan & Co. have published during the last year a work entitled Angola and the River Congo, by Joachim John Monteiro. The author speaks very disparagingly of the prospects of civilizing the natives. The same gentleman has a paper on a kindred subject in vol. v., part ii., of the Journal of the Anthropological Institute.

M. Clermont Ganneau reviews the ancient inhabitants of Palestine in the August number of *Macmillan's Magazine.* The London *Athenæum* of December 11, 1875, contains a letter from the Rev. Selah Merrill, archæologist of the American Palestine Exploration Society, in which he reports a visit to Um El Jemal, the Beth Gamul of Jeremiah, in the neighborhood of Bozrah and Salchad.

Professor Fischer, director of the Mineralogical and Geological Museum of Freiburg, Baden, has sought to organize a new branch of antiquarian study, namely, mineralogical archæology. His object is to ascertain, by a microscopical and chemical examination of nephrite, jadeite, and other substances of which stone implements are made, the exact source of these materials, and also the migrations of the people who used them.

An Indian Rock-Shelter in Lancaster County, Pennsylvania. — Professor Haldeman has lately discovered an interesting series of Indian relics in a small cave, or more properly rock-shelter, at the western side of Chickis Rock, Lancaster County, Pennsylvania. This rock

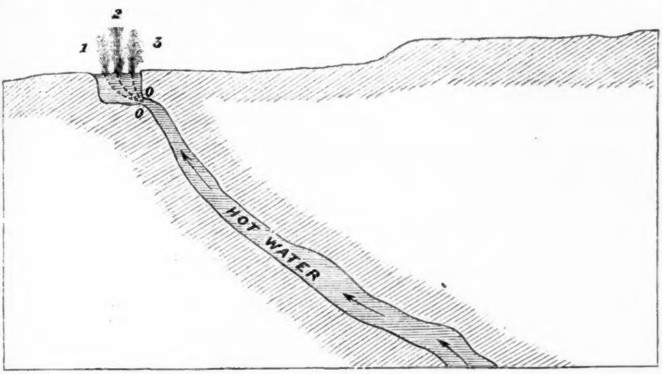
or cliff, he informs me, is of quartzite (Potsdam sandstone), which has the curve of an anticlinal axis, the base of which may be called a cave. This is arched, high enough for a man to stand at the entrance, with the roof declining backwards and on each side to the ground; the width and depth about twelve feet. The "find" of specimens consists of one hundred and thirty arrowheads, of quartz, jasper, limestone, and chalcedony; one banner-stone or sceptre, a perforated implement resembling a tomahawk; eight chisels, mostly of quartz; two pipe-stems, three net-sinkers, and about one hundred fragments of pottery. As the characteristic specimens of this find, with full details of their discovery, will shortly be illustrated and described, we will not refer more particularly to them. The specimens here briefly referred to were found beneath a deposit of rich black mold, varying from two and one half to three feet in depth. If this deposit is solely due to the decomposition of vegetable matter, the contained relics indicate that very far back in the past the red man had arrived at an advanced stage of neolithic culture; for the specimens as a class are of excellent workmanship. — CHARLES C. ABBOTT, M. D.

THE TASMANIANS. — In a recent memoir on the osteology and peculiarities of the Tasmanians, who have recently become extinct, Dr. J. B. Davis records his belief that they represent a type distinct from the Australians. Besides presenting osteological differences, the Tasmanians never used the boomerang or shield, although they had a larger brain, and were intellectually superior to the Australians. Like the Australians, however, the Tasmanians never made pottery. Although Tasmania is situated but a little more than three hundred miles from Australia, Davis thinks there was never any communication between the two peoples. In confirmation of this view he states that the Tasmanians neither had native dogs nor practiced circumcision, a custom very general among the Australians. "All that can be said with truth is that the Tasmanians are not Australians, they are not Papuans, and they are not Polynesians. Although they may present resemblances to some of these, they differ from them all substantially and essentially. From all this we are justified in asserting that the Tasmanians were one of the most isolated races of mankind which ever existed; that they were a peculiar and distinct race of people, dwelling in their own island, and different from all others. And they have been one of the earliest races to perish totally by coming into contact with European people." The population of Tasmania at the time when first visited by Europeans was between four thousand and seven thousand. The last native died three years since.

GEOLOGY AND PALÆONTOLOGY.

HOT SPRINGS AND GEYSERS. — We extract from Prof. T. B. Comstock's Report on the Geology of Wyoming the following remarks on the difference between hot springs and geysers: "In the ordinary hot

spring the spurting of the liquid, when it occurs, is owing to a resistance offered to the direct escape of the expansive force from below, and this resistance may be found in the tenacity of the liquid contents of the bowl, in the untoward shape of the bowl or its connected passages, or in the sudden restriction of the orifice near the surface of the liquid. In either case the uprising force is condensed, as it were, near one point, and the spurt or eruption is caused by the sudden overcoming of the tension when the force has become sufficiently concentrated to free itself from its confinement. Thus we may meet with a great variety of spouting thermal springs, resulting from two or more of these causes combined, and the force may be produced by heat alone or by the evolution of carbonic acid or other chemical change in addition. (See Figure 14.)

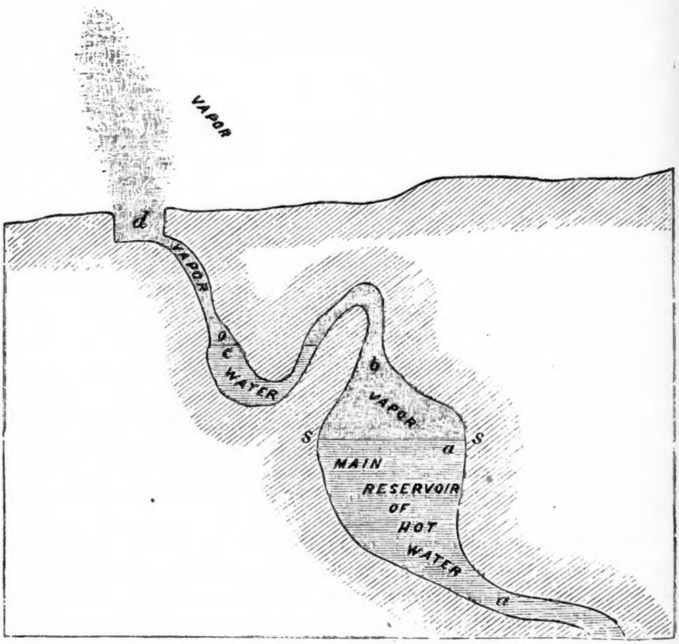


(Fig. 14.) IDEAL SECTION OF A THERMAL ERUPTIVE SPRING.

The arrows represent the direction of the action of the subterranean force. The channel is constricted at *o o*, the entrance of the surface bowl; 1, 2, 3 represent the variable position of the successive jets.

"The phenomena observed in connection with the typical geyser, however, do not admit of such a simple explanation; and there is much doubt whether existing theories are sufficient to account for all the common manifestations of such agitated bowls. Almost without exception, in the true geyser, the action, whether frequent or the reverse, is intermittent, although the successive periods in each case may be quite irregular. Usually, as the first indications of an approaching eruption, there will be noticed an escape of vapor, soon followed by a sudden rising of a mass of water sufficient to fill the surface-chamber of the geyser. The phenomena which follow are very largely the result of structural features of varying nature, no doubt, but it will invariably be found that the eruption takes place near the centre of the bowl, and that the elevation of the column of water is accomplished by continuous or successive throes from one spot, while in the ordinary eruptive springs the column is seldom shot upward from the same point twice in succession. We

must, therefore, believe that the propelling power in the geyser acts temporarily and suddenly, while in the common hot spring, quiet, boiling, or eruptive, constant or periodical, the force is evolved with considerable regularity. The idea which the writer desires to convey will be rendered more evident by the comparison of Figures 14 and 15. Figure 14 shows the supposed section of a common eruptive spring; and it will readily be seen that jets may even occur in cold springs of this structure, provided a quantity of carbonic acid or other gas is struggling to free itself from beneath the ledge at *o*. In Figure 15, which is intended to represent the



(Fig. 15.) IDEAL SECTION OF AN INTERMITTENT GEYSER.

To illustrate the phenomena of eruption during the escape of vapor, prior to the ejection of hot water.

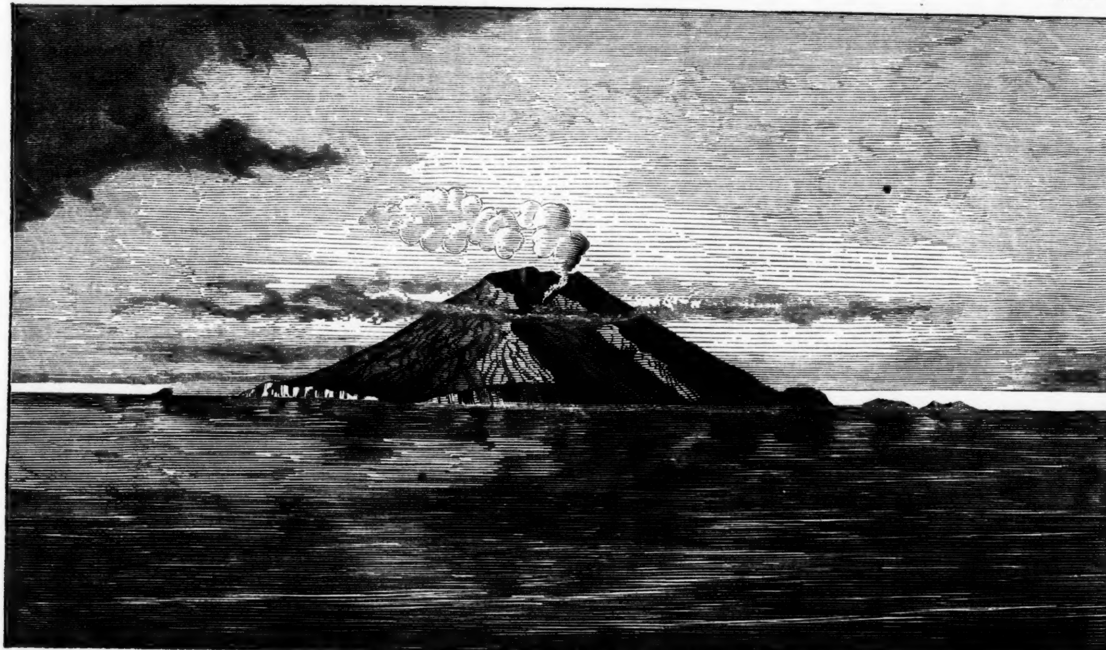
supposed condition of the subterranean geyser-waters in the first stage of an eruption, the reservoir *a* is supposed to contain water which remains in equilibrium nearly at the level *ss*. By constant accessions of heat from below, the vacant passage above is finally filled with vapor, and by degrees the water in the bent passage *c* becomes heated, and evolves vapor also, as in *o*. After a time, the expansion of the vapor in *b* is able to overcome the combined pressure of the water and vapor in *c* and *o*, when the latter is forced out, followed by a portion of the water in the reser-

voir *a*. The force thus expended, a vacuum is produced in *b* by the receding of the column of water in *a*, and the foregoing operations are indefinitely repeated. This theory seems capable of explaining the facts so far as they are known, and the variations observed in special cases, or even in different eruptions of the same geyser, appear to the writer to require but slight modifications of the section, and none that are of great importance. The passage *c* may be kept filled with water by means of the surplus which falls back into the bowl.

"Bunsen's theory of geyser action, which has not yet been proven inadequate to explain the more prominent features of eruptions, does not seem sufficient (to the writer) to account for all the differences between the geyser and the mere hot spring, but it must not be inferred that such excellent authority is disregarded. On the contrary, the author proposes the structural hypothesis simply as a supplement to the superheating theory of Dr. Bunsen, in order to explain surface phenomena common in the Fire-Nob basins, which appear to require an extension of his views. At the same time it must be confessed that there are objections to his theory, based upon these observations, which are difficult to reconcile. It will be impossible to present these here, but an outline of the theories in question is appended. Bunsen has shown that an eruption may be artificially produced by introducing steam near the base of a long, narrow column of water, which causes the water, as it rises under pressure, to become super-heated, the surplus heat being used for the production of more steam, which adds to the elevating force. This admirable theory, of which the above experiment is an illustration, is based upon a series of ingenious observations among the hot springs of Iceland. Bischof adopts an opinion almost identical with the structural hypothesis here proposed, and the present author, it will be remarked, combines the two theories, believing both necessary to explain all the facts observed."

THE MECHANISM OF STROMBOLI.—As apropos to the subject of geysers we would direct the reader's attention to an able article on Stromboli by the late G. Poulett Scrope, published in the *Geological Magazine* for December, 1874, and illustrated by a view of Stromboli, which is here reproduced (Plate I.) through the courtesy of the publishers, the Messrs. Trübner & Co. Mr. Scrope attacks Mallet's suggestion that the mechanism of Stromboli has not merely some similarity with that of a geyser, but that the volcano actually contains a geyser in its inside. In this connection he quotes Lyell's Principles, in which it is stated that the phenomena of geysers "have no small interest as bearing on the probable mechanism of ordinary volcanic eruptions, namely, that the tube itself is the main seat or focus of mechanical force." Scrope then refers to his own theory, which corresponds to the views of Lyell and Dana. The opinion of the latter he quotes as that "of an impartial and unquestionable authority" (Dana's Manual, 1863, page 692). Mr. Scrope shows that "there is no ground whatever for attributing to Stromboli any mechanism different from that of ordinary volcanoes."

PLATE I.



STROMBOLI VIEWED FROM THE NORTH. (*After* ABICH.)

THE MOUNTAINS OF NEW ZEALAND. — In the coast scenery of New Zealand, with its deep fiords and mountains, none of which, however, rise above an elevation of nine or ten thousand feet, we find some interesting similarities to the scenic features of the Pacific coast of Oregon and Alaska. An interesting account of the physical geography of New Zealand, particularly the province of Otago, is given by Messrs. Hutton and Ulrich in their Report on the Geology and Gold Fields of Otago. The sounds or fiords were in one case found to be 1728 feet in depth. Mr. Hutton notices the points of difference between the Alps of Switzerland and those of New Zealand. "No one," he says, "after visiting the Alps of New Zealand, could fail to notice two remarkable points of difference between these mountain regions. The one is that mountains with sharp, serrated summits, which are the exception in Switzerland, are the rule in New Zealand, and the other is that the numerous large waterfalls which the traveler in Switzerland sees at almost every turn are quite exceptional in New Zealand. A few waterfalls, but they are very few in comparison with Switzerland, are found in the deep fiords on the west coast, and a few smaller ones towards the heads of the valleys in the heart of the mountains, and these are nearly all. And yet the mountains in New Zealand are quite as rough and rugged as the Alps of Europe, and indeed the gorges are more numerous and deeper. There are also other minor points of difference."

GEOGRAPHY AND EXPLORATION.

CAMERON'S EXPLORATIONS IN TROPICAL AFRICA. — Cameron's achievement stands quite alone. For the first time in the history of the world a European traveler has walked across tropical Africa from east to west. But Cameron has done more. This wonderful march of three thousand miles is but a portion of his work. He has taken such a series of scientific observations as will place him in the foremost rank of practical geographers; he has surveyed the southern half of the great Lake Tanganyika, has solved the problem of the course of the Congo, and has fixed the position of the water parting between the Congo and the Zambesi.

Born in 1844, and having entered the navy in August, 1857, Lieutenant Cameron was only twenty-eight when he received his instructions from Sir Bartle Frere at Zanzibar, and took command of the Livingstone East Coast Expedition. His previous services, which qualified him for this important charge, are recorded at page 274 of *Ocean Highways* for December, 1872. His instructions, dated February 14, 1873, were to take up supplies to Dr. Livingstone, and to carry out such exploration as he might direct or advise, it being specially pointed out that the completion of the survey of Lake Tanganyika was work of great importance. Accompanied by his friend and old messmate, Dr. Dillon,

R. N., and by Lieutenant Murphy, R. A., Cameron made a final start from the east coast for the interior on the 18th of March, 1873.

The young lieutenant showed his admirable fitness for the work from the first. There were special and peculiar obstacles which entailed very heavy expenditure, and Dr. Kirk was of opinion that no expedition, starting from Zanzibar, ever had so many difficulties to encounter. Cameron gallantly faced and overcame them, and, in spite of them all, he reached Unyanyembe on the 4th of August, 1873.

At this place all the members of the expedition suffered terribly from illness. Out of forty-five days Cameron himself was down with fever during twenty-nine, and was afterwards prostrated by a still more serious fever, of a remittent type, and inflammation of the eyes. It was here that the faithful servants of Livingstone, bringing with them the remains of the great traveler, and his journals and other effects, joined the relief expedition and received that aid which enabled them to reach the coast. Lieutenant Cameron sent down the Livingstone caravan to the coast, in charge of Lieutenant Murphy, with ample supplies for the journey; and the continued illness of Dr. Dillon obliged him also to return. The party left Unyanyembe on the 9th of November, 1873, and on the 17th, Cameron's friend, Dillon, "a skillful and zealous officer, and a highly accomplished scholar and firm and steadfast friend," succumbed to the effects of overwork and a pestiferous climate.

Cameron was now alone; but his work was not yet done. Livingstone's servants had reported that a most important map belonging to the doctor had been left at Ujiji, without which the record of the great traveler's discoveries would be very incomplete. It seemed to the young explorer that its recovery was a sacred duty, and he also considered himself bound to do his utmost, with the means at his disposal, to further the cause of geographical discovery. With these objects, but still suffering acutely from the effects of fever and ophthalmia, Cameron set out from Unyanyembe for the west on the 11th of November, 1873. He kept on steadily working "westward ho!" with dauntless perseverance, until he reached the shores of the Atlantic.

Traveling through a difficult and entirely new country, he discovered several of the southern tributaries of the Malagarazi and the interesting region they water, and on the 21st of February, 1874, he reached the shores of Lake Tanganyika.

Cameron's first great geographical exploit after reaching Ujiji was the survey of Lake Tanganyika, which he ascertained to be 2754 feet above the level of the sea. He launched his boats in March, 1874, closely examined and surveyed the whole southern half of the lake, discovered the great stream called Lukuga, flowing out of it, and returned to Ujiji on the 9th of May. His invaluable map of the lake will be found facing page 72 of the *Geographical Magazine* for March, 1875, and was also published in the Proceedings of the Royal Geographical Society. Cam-

eron has since been informed that Lukuga, the outlet of Lake Tanganyika, falls into the Lualaba above the junction of the Lurwa and the Kamorondo.

The gallant explorer started from Ujiji on his lonely and chivalrous expedition on the 20th of May, 1874, and, after traversing the Manyuema country, arrived at Nyangwé on the Lualaba, the farthest point reached by Livingstone, in the following August. He found that Livingstone had placed this station ninety miles too far to the west. It proved to be only fourteen hundred feet above the level of the sea, which at once puts an end to any notion of the Lualaba being connected with the Nile system. Instead of flowing north, the Lualaba here turns to the west, and then west-southwest, eventually entering and flowing through a great lake called Sankowa. The river receives many tributaries from the south, and one very large stream from north of the equator, called the Lowa. Thus the drainage from both north and south of the equator accounts for the two rises in the Congo. For Cameron has now fully established the identity of the Lualaba and the Congo.

The advance from Nyangwé, Livingstone's farthest point, was the most momentous crisis in Cameron's undertaking. The difficulties were great. It was impossible to obtain canoes. The chief beyond the Lomané, which here falls into the Lualaba, declared his resolution of making war if the explorer attempted to cross his country. He was thus diverted from his intended route down the course of the Congo. But he was not to be stopped. The route he actually did take was of equal importance, and led to equally valuable geographical discoveries. It led south from Nyangwé, up the eastern side of the valley of the Lomané, to Kilemby, the capital of a great chief named Kasongo, who ruled over all the country of Urua.

The Urua country was first made known to us by Captain Burton, in his Lake Regions of Central Equatorial Africa, who calls it Uruwwa, "a central district west of Tanganyika," with a ruler named Kiyombo, who was friendly to the Arabs, and traded in ivory, staves, and copper from Katanga. Dr. Livingstone also heard of the same country, which he called Rua; but Cameron was the first to discover it and fix its position.

Cameron remained at the capital of Urua from October, 1874, to February, 1875. It is a most important central point, for here the traders from the east and west meet. Cameron found an Arab merchant named Jumah ibn Salim, from Zanzibar, and also two mulatto traders named Alriz and Coimbra, from Bihé in Benguela. His long detention in Kasongo's country enabled the explorer to collect much valuable geographical information respecting the whole of this part of tropical Africa, including a complete and detailed account of the rivers and lakes which feed the Congo from the south. He discovered a new lake called Kassali, through which the Lualaba flows; and another, with no outlet,

called Möhoya, which is specially interesting from having regular lake villages on its waters. He discovered also that the Lomané is a distinct river from the Kassabé, receiving a large stream called Luwembi from the west, coming from a lake called Iki, probably the Lake Lincoln of Livingstone. Katanga, the famous copper-yielding district, within the territory of Urua, is situated between the rivers Lualaba and Lufira, which unite, and the combined stream, after flowing through a chain of small lakes, receives the Lualaba of Livingstone, which is really the Lurwa. The united rivers then flow through Lake Lanji (the Ulengé of Livingstone), and past Nyangwé to Lake Sankowa, and thence, as the Congo, to the sea. Cameron ascertained the names and positions of all the different tributaries of these rivers, and will be able to give a complete account of the hydrography of this newly-discovered region of the Upper Congo.

After many vexatious delays, Cameron, accompanied by the mulatto Alriz, set out from Kasongo's country for Benguela. His course led him past the sources of the Lomané and the Luwembi, and close to the sources of the Lulua he came upon water flowing to the Zambesi. He traveled over a rich table-land, with numerous streams, to Sha-Kilembe's town, which he reached in September. The nights were cool on this elevated plateau, and on two occasions there was actually frost, when Cameron enjoyed the feeling of the crisp soil crunching under his feet. Sha-Kilembe is the Ya-Quilem of Ladislaus Magyar. It is on the river Lumèji, a tributary of the Liambeje, in latitude 11° 31′ south and longitude 20° 24′ east.

As the travel-worn party approached the goal, all nearly spent, and with supplies at the lowest ebb, their leader performed an additional journey of a hundred and twenty geographical miles, in order to bring assistance to his native followers. The route led from Sha-Kilembe to Bihé, and thence to the Portuguese town of Benguela, on the shores of the Atlantic, where Cameron arrived last October, and whence he proceeded to Loanda to recruit his health. Thanks to the forethought of the Viscount Duprat, the great traveler received every attention and much kindness from the Portuguese officials. As soon as he has found means of sending his other followers to Zanzibar, he will return home with old Bombay, the veteran servant of former travelers, and a small boy named Jacko, who accompanied him from Unyanyembe.

When Cameron arrives in this country, and fills in the details of the mere skeleton route which is now before us, we shall have a story of unsurpassed interest, whether we consider the great geographical discoveries he has made, the new regions he will describe, or the personal narrative of the intrepid sailor himself.

But Cameron's extraordinary merit rests mainly on the number and value of his scientific observations. The total distance over which he has marched from Zanzibar to Benguela is 2953 miles. Along this

route he has fixed 85 positions and taken 706 observations, consisting of 137 for latitude by stars north and south of the zenith, 196 for time, 368 lunar observations, one for the sun's eclipse of April 6, 1875, and four amplitudes for compass variation. His method of observing lunars for longitude is of the first order, namely, by stars east and west of the moon's enlightened limb; and by computing his observations, he has not only laid down his route accurately, but has also projected a remarkable section of the country over which he traveled, from the Indian Ocean to the Atlantic. The heights of places above the sea are determined by four Casella's aneroids, including 3718 observations, and by 70 observations of five boiling-point thermometers. The itinerary gives the approximate latitude and longitude of all the places visited, and their distances from each other; and by this itinerary, with the observations for height, the section sheets have been projected. Cameron also collected a vocabulary of the language of interior Africa, comprising fourteen hundred words.

The vast importance of Cameron's discoveries, which establish on a firm basis the geography of south tropical Africa, cannot be fully appreciated and understood without a carefully prepared map accompanied by a critical commentary, which will be published in our number for March. Meanwhile we may look for the return to this country of the great traveler himself, where he will receive a hearty and cordial welcome.

But Cameron himself has abstained from laying any claim to theoretical or hypothetical discoveries, and has merely stated facts that have come under his observation, and the reports he has collected from Arabs and natives. He has never claimed the discovery of the outlet to Lake Tanganyika. He has simply described a stream, called the Lukuga, which he found to be flowing out of the lake, and the course of which he followed for four miles. He leaves deductions to geographers at home, while he furnishes them with accurate data for forming their conclusions. It is Burton who has generously called his young successor "the second discoverer of Tanganyika." Cameron's observations are more complete than those of any previous traveler, but he speaks with characteristic modesty of his discoveries. "As for geographical work," he says, "I have cleared up a lot of mistiness, if not positive darkness; but the work is immense, and ought to be taken in hand thoroughly, and not by desultory expeditions which make their way to one point, and then have to come away with their work unfinished. Fresh men should take up the work of their predecessors, instead of, as at present, every man having to hunt for his own needle in his own bundle of hay." If all travelers worked and observed as Cameron has done, there would be little left to desire. — *Extracted from The Geographical Magazine for February.*

MICROSCOPY.[1]

Mode of Production of Microscopical Images. — Professor Abbe, of Jena, has lately[2] established a conception of the manner by which images are produced in the microscope, which is entirely different from those usually adopted. The microscopical image of the object is formed by the superposition of two images, which have an entirely different origin, and can in fact be conceived to be separated one from the other. One image is a *negative* one, by which all parts are represented as a geometrical likeness by the unequal emersion of the rays of light passing through the object. This image is called by Abbe "absorption image." It represents the *definition* of the microscope.

The other image (formed by as many partial images as there are bundles of rays which have been isolated from the cone of light, and pass into the object) is *positive*. It is an image produced by refraction, and represents the *penetration*, that is, the finer structure of the object. Wherever the structural elements of the object are small enough and approximated enough, phenomena of diffraction appear. The consequence is that structural images, produced by a coöperation of the fraction of the rays of light, are not in a constant connection with the real structure of the object which produced it, but in constant connection with the phenomenon of diffraction which brought about the image.

Microscopical images, therefore, showing systems of fine lines, as in diatoms, do not allow us to infer with safety the morphological existence of such structures, but only the existence of structures necessary to bring about such images. Consequently, the smaller the linear dimensions of a structure, the more unsafe are the conclusions respecting the real structure as indicated by the image. It can therefore never be decided with certainty by what sort of structure the systems of lines (as for instance those of *Pleurosigma angulatum*) are produced, nor will the image of the finer transverse lines of muscular fibres give certain conclusions about the arrangement of the finer details of structure. This want of certainty may also apply to differences in the degree of transparence of objects, their color and polarization.

Abbe's researches allow us to limit with certainty the powers of the microscope. "Never can parts be seen which are so nearly approximated that even the first bundles of rays of light produced by fraction are not able to enter the objective at the same time as the unbroken cone of light." Every aperture of the objective has a fixed limit for the smallest distance of objects by which it is possible to see the object.

Any new perfection of the microscope cannot go much further than to show for central illumination the whole length of one wave of blue light, and for the greatest possible oblique illumination half the length of a wave.

1 This department is conducted by Dr. R. H. Ward, Troy, N. Y.

2 Archiv für mikroskopische Anatomie, 1873, ix. 413–468.

It may therefore be observed that no microscope will show any more of the structure of an object than it is possible to see by an immersion-objective of a power of two hundred diameters. Helmholtz[1] arrives at the same results by another mode, giving the smallest perceptible distances for the middle greenish yellow light, 0.000275 mill. = $\frac{1}{3636}$ mill. — H. Hagen.

[We print this abstract of Professor Abbe's curious researches, though not without mental reservations in regard to some of its conclusions. — Ed.]

Tyndall Association. — The second annual "Science Exposition" of this active society was given at the City Hall, Columbus, on the evenings of December 7, 8, 9, and 10, 1875. A prominent part of the exhibition was the microscopy, in charge of the president of the microscopical section of the society, Rev. I. F. Stidham. Objects calculated to prove attractive to a popular assemblage were displayed upon microscopes furnished mostly by the members of the society, and an explanatory lecture was delivered on the first evening by Prof. A. H. Tuttle. The instruments, over thirty in number, were by nearly all the familiar makers, the following maufacturers being those that were represented by more than one each: Beck, Queen, Hartnack, Grunow, Ross, Zentmayer, Crouch, and Fields.

Sonorous Sand. — The "musical beaches" which occur at some points on the New England coast and in Georgia, as well as at the more famous localities in Arabia, Switzerland, the Hebrides, and the Sandwich Islands, have lately been attracting much attention from microscopists. When handfuls or larger quantities of the sand are rubbed together, a musical sound is produced which seems to be due to the numerous microscopic pits or cavities which abound in the grains of sand. These pits are especially conspicuous and interesting in the Sandwich Islands sand. Moisture, which would temporarily obliterate the cavities, prevents the sound.

Exchanges. — A photograph of any specially interesting microscopic object will be furnished in exchange for the use of the object from which to obtain a negative. The object itself will be returned uninjured within one week. Address proposals to R. H. Bliven, Elmore, Ohio. — Double-stained vegetable sections in exchange for good mounted objects W. G. C., 103 Warren Avenue, Boston. — Slides of sonorous sand from Sandwich Islands in exchange for any good mounted objects. W. G. C., 103 Warren Avenue, Boston.

Unmounted Objects. — C. A. Baldwin has transferred the agency for distributing these objects to Prof. H. A. Ward's museum, Rochester, N. Y., from which they can be obtained in future.

J. W. Queen & Co. — The changes recently noticed in this firm refer only to the New York house.

[1] Ueber die Grenzen der Leistungsfähigkeit der Mikroskop, Monatsberichte der Berlin Akademie, 1873, page 625.

SCIENTIFIC NEWS.

— The annual report of the trustees of the Museum of Comparative Zoölogy contains plans of the museum building, with a view of the wing, now partly built, together with its proposed addition and the corner-piece joining it to the main building. The curator, Mr. Alexander Agassiz, seems to discourage the accumulation of great stores of alcoholic specimens, suggesting that they should be restricted to a minimum, and limited, as far as possible, to those classes where no other mode of preservation is practicable; and he thinks "the time has come when large collections must naturally be supplemented by zoölogical stations. These, when once established at properly selected localities, will enable museums to dispense with much that is now exceedingly costly." By the success of the Agassiz Memorial Fund, the authorities will be enabled, as soon as the contemplated additions to the museum are erected, to carry out the principal ideas of Professor Agassiz for the arrangement of a museum. This fund is stated to amount to $310,673.99.

— A new marine Fucoid from the Water Lime Group, at Buffalo. N. Y., has been noticed by Messrs. Grote and Pitt, under the name of *Buthotrephis Lesquereuxi.* The specimen is one of the best preserved of the kind yet discovered. No remains of sea-weeds appear to have been known hitherto from the Water Lime Group of the Silurian formation.

— The third volume of the new edition of the Encyclopædia Britannica, just published, contains articles on the Atlantic and Baltic, by Dr. W. B. Carpenter, and on Biology, by Professor Huxley and W. T. F. Dyer.

— The *Progress of Darwinism* is an annual issued in Germany, giving the annual record of evolution literature, as part of a series of other reports on the progress of geology, meteorology, etc.

— Among the recent books of travel published by E. H. Mayer, Cologne and Leipzig, are the three following, by Robert von Schlagintweit: Die Prairien des amerikanischen Westens (The Prairies of Western America); Die Pacific-Eisenbahn in Nordamerika (The Pacific Railroad of North America); and Die Mormonen, oder die Heiligen vom jüngsten Tage (The Mormons, or Latter-Day Saints).

— A summer school of science and physical culture on a rather novel plan is projected by Prof. D. S. Jordan, who proposes to take a class of twenty on a march from Indianapolis to the upper waters of the Tennessee, thence by boats down the French Broad and Tennessee, to Chattanooga, where the school will be closed.

— A memoir of the late I. A. Lapham, LL. D., who suggested the U. S. Weather Signal System, has been prepared by Mr. S. S. Sherman.

— Élisée Reclus is editing Nouvelle Géographie universelle, la Terre et les Hommes, of which six livraisons had appeared in Paris up to November last.

PROCEEDINGS OF SOCIETIES.

Academy of Natural Sciences, Philadelphia. — February 24th. Professor Cope gave a history of the progress of the doctrine of evolution of animal and vegetable types. (This is printed elsewhere in this number of the Naturalist.) Dr. Allen called attention to a remarkably prognathous human skull, from Australia, belonging to the academy, in which the monkey-like characters were unusually apparent. Other peculiarities observable only by anatomical experts were pointed out. A paper by Dr. Charles A. White, entitled Descriptions of Fossils from Palæozoic Rocks of Iowa was presented for publication.

Academy of Science, St. Louis. — February 7th. Prof. C. V. Riley remarked on insectivorous plants, stating that while *Drosera*, *Dionæa*, etc., actually digest animal matter, the only benefit *Sarracenia* received from captured insects was from the liquid manure resulting from their putrescent bodies.

Society of Natural History, Boston. — February 16th. Prof. William B. Rogers presented some geological notes on the thickness of the Virginia Tertiaries as indicated by the artesian borings at Fortress Monroe; on the Upper Secondary Sandstone of Virginia as including an ancient drift, and its relation to the post-tertiary cobble-stone deposit; with suggestions in explanation of the course assumed by all the great rivers of the Middle States on entering the region of tide-water.

Professor W. G. Farlow remarked on the nature and mode of growth of the "black knot" of plum and cherry trees. This is an American fungus, and has spread from our wild plums and cherries to the cultivated trees. Professor Farlow recommended the wholesale destruction of our wild species, especially *Prunus Virginiana*, as breeders of the disease, which, if followed up by careful pruning of trees in cultivation, could not fail finally to eradicate the black knot.

Cambridge Entomological Club. — January 14th. It was voted that a publication fund should be established, amounting to at least two thousand dollars, the interest of which should be expended in publishing *Psyche*, as in no other way would it be possible to maintain the publication of the Bibliographical Record of North American Entomology, which is already recognized as more complete than any other similar record of any department of science. A committee was appointed to obtain this fund.

Mr. Scudder pointed out the presence of some hitherto unparalleled glands in the thorax of *Anisomorpha buprestoides*, and presented a paper upon the subject for publication in *Psyche*.

Mr. J. H. Stebbins, Jr., mentioned the capture, near London, of a *Papilio Machaon* which had five wings. The specimen is now in the British Museum.

February 11th. Mr. Scudder said that he considered that Mr. Riley

had proved by his recent investigations that *Megathymus yuccæ* is a butterfly, and forms a new group of Urbicolæ.

Mr. Scudder exhibited a dissection of *Autolyca pallidicornis*, to show the interior glands corresponding to the prothoracic excretory openings to which he had called attention at the previous meeting, when speaking of the function of these organs in *Anisomorpha buprestoides* (*Spectrum bivittatum*) and in Phasmidæ generally.

Mr. Fewkes exhibited drawings to show the structure and position of these glands. Mr. Dimmock exhibited wings of Microlepidoptera which had been bleached and mounted as microscopic objects; some of these had been colored after bleaching, so as to show that the scales still remained.

Troy Scientific Association. — February 21st. Wm. E. Hagen read a paper on the curiosities of gold and gold mining, giving prominence to those facts that might have given plausibility to the theory of the derivative character of this metal. An abstract of this paper will be published in another number of this journal.

SCIENTIFIC SERIALS.[1]

The Annals and Magazine of Natural History. — January. On the Classification of Scorpions, by T. Thorell. First Report of the Naturalist accompanying the Transit of Venus Expedition to Kerguelen's Island in 1874 (conclusion), by A. E. Eaton.

Monthly Microscopical Journal. — February. Remarks on the Foraminifera, with especial Reference to their Variability of Form, illustrated by the Cristellarians, by T. Rupert Jones.

The Geographical Magazine. — January. The Swedish Arctic Expedition. The Malayan Peninsula, by H. St. John. On former Physical Aspects of the Caspian, by H. Wood. Is it Possible to Unite the Black Sea and the Caspian? by D. Ker. The Western Sahara, by E. G. Ravenstein (with a map). February. Dr. Beccari's Recent Visit to New Guinea, by H. H. Giglioli.

American Journal of Science. — March. Structure of *Obolella chromatica*, by E. Billings. On the Damming of Streams by Drift Ice during the Melting of the great Glacier, by J. D. Dana. On Flint Implements from the Stratified Drift of Richmond, Va., by C. M. Wallace. Principal Characters of the Tillodontia, by O. C. Marsh.

The Geological Magazine. — February. Sketch of the Geology of Ice and Bell Sounds, Spitzbergen, by A. E. Nordenskiöld. Remarks on the New Hebrides Group, by H. Hosken.

Nature. — January 27th, and February 3d. Professor Tyndall on Germs. Professor Nordenskiöld on the Jenisei.

[1] The articles enumerated under this head will be for the most part selected.

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